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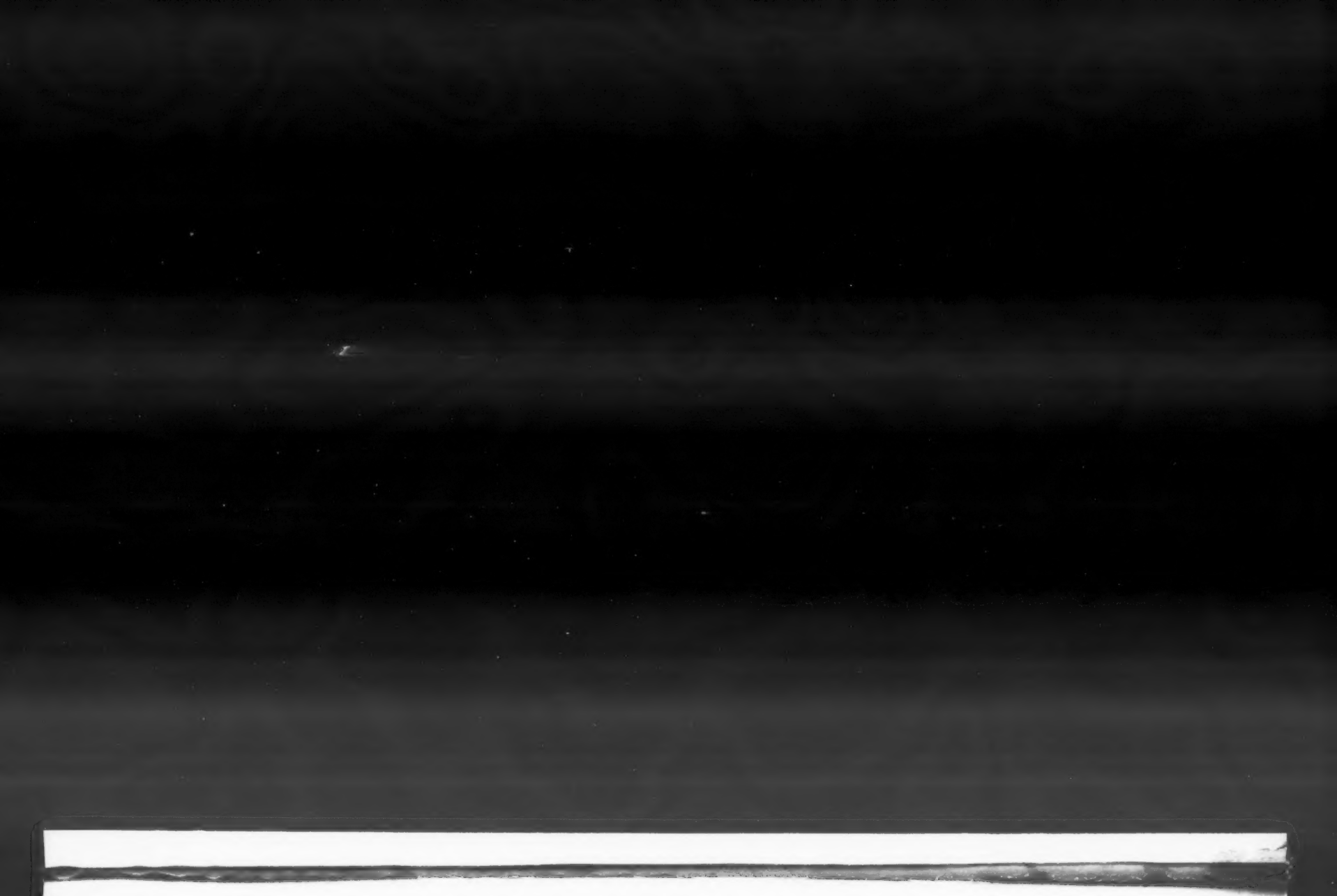
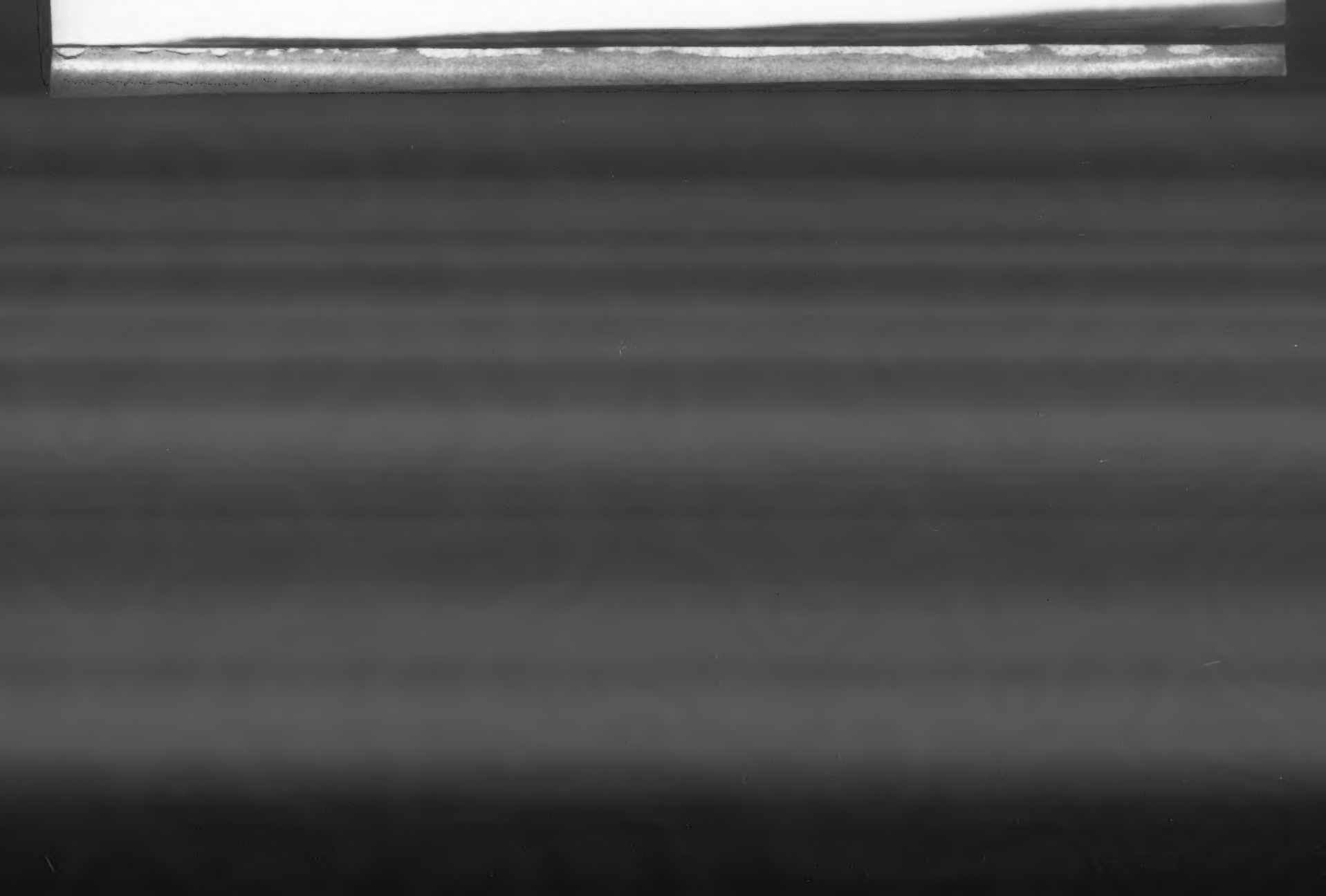




MUNICIPAL ENGINEERING

VOLUME XXIX. NOVEMBER, NINETEEN HUNDRED FIVE. NUMBER FIVE

FRANCHISES FOR GAS COMPANIES.

By Charles Carroll Brown, Mem. Am. Soc. C. E., Indianapolis, Ind.

The number of inquiries regarding the special features of gas franchises granted in Indianapolis warrants some statement of their provisions and a sketch of the development of the ideas expressed in them.

The earliest act establishing a gas company for Indianapolis was passed by the State Legisature in 1851, and authorized the furnishing of gas "for the purpose of lighting the city of Indianapolis or streets thereof, and any buildings, manufactories, public places or houses therein contained," for twenty years. Ordinances were passed by the City Council from time to time, making contracts with the gas company for supplying the city with gas and for rates for supplying private consumers. The contract and ordinance under which the company is now operating was approved July 5, 1899, and will be in force for ten years from that date. It provides a sliding scale of rates for gas, which has now reached its minimum of 90 cents a thousand cubic feet, since the consumption is now more than 250,000,000 cubic feet a year. The gas must be of the highest standard of purity and of not less than eighteen candle power when five feet per hour is consumed at a pressure not exceeding 0.2 inch in a lava-tipped Bunsen-Argand burner, the standard candles burning 120 grains of sperm per hour. Quality, pressure, extension of mains, accuracy of meters, restoration of streets, forfeitures and indemnities are provided for adequately.

A competing gas company seems to have been started in 1876 and, after several changes, to have absorbed the earlier company, notwithstanding a provision in its original franchise from the city prohibiting selling to or consolidating with the older company.

The several natural-gas companies which operated in the city when natural gas was obtainable accepted an ordinance approved June 27, 1887, which fixed flat rates and methods of construction and operation, and also provided for a meter rate for natural gas of not more than 10 cents a thousand cubic feet. Two special ordinances for companies supplying gas for factories were passed in 1892 and 1893.

None of these are of special interest except the Consumers' Gas Trust Company. The foundation and method of operation of this company are described in detail in MUNICIPAL ENGINEERING, Vol. xiv, p. 181, in an article entitled "A Successful Substitute for Municipal Ownership," by Alfred F. Potts, who was the author of the plan. The principal features are the creation of a self-perpetuating board of trustees, to which all stock was transferred for voting purposes, such as the election of the board of directors, and the repayment of all stock, with 8 per cent. interest, out of the profits of the operation of the company, after which the service would be reduced to cost. The establishment of this company saved the people of Indianapolis more than $1,000,000 a year during the natural-gas period by preventing the doubling of the gas rates fixed in the ordinance of 1887, which was demanded by other companies before they would enter the city.

The profits of the Consumers' Gas Trust Company were sufficient to repay all the money subscribed for stock, with 8 per cent. interest, under the provisions of its incorporation. About the same time that the stock was paid up the supply of natural gas became so low that the expense of operating the company became greater than the income and the service was so unsatisfactory that it could no longer be continued.

It was then proposed to enter upon the manufacture of fuel gas, using the organization of the Consumers' Gas Trust Company for this purpose. Some of the stockholders in the company, who had

not accepted their final dividend in repayment of stock pending the settlement of questions of ownership, secured court decisions to the effect that the company was not authorized under its charter to manufacture gas, that the company should sell its property and distribute the proceeds among the stockholders, and that the city could not purchase the property under the clause in the charter whereby the company agreed to sell to the city at an appraised value. This last decision was based on the principle that a corporation cannot sell the means whereby it fulfills its contract with its patrons, and has no power to make an agreement for such sale. From these various decisions result the anomalous conditions whereby the company is not able to contract to sell its property, but is ordered by the court to sell it. The last decision has been appealed from, and the higher court has not yet passed upon it.

The artificial-gas company has a system of pipes through which it supplied natural gas under the general natural-gas ordinance above referred to. This company withdrew from its natural-gas business before the Consumers' Trust Company ceased operations. As the charter of the artificial-gas company, the Indianapolis Gas Company, provides for the supply of artificial gas for lighting only, the City Council passed an ordinance, after the natural-gas branch of this company's business had been discontinued, authorizing the company to furnish artificial gas for fuel purposes at a price not greater than 50 cents a thousand cubic feet, which price is 40 cents less than the price for illuminating gas. This ordinance has never been accepted by any company.

When it was decided that the Consumers' Gas Trust Company could not manufacture gas, steps were at once taken to establish a new company upon a similar basis with the necessary power to manufacture gas. Into this franchise were introduced some provisions to obviate some of the dangers in the former company and some selected from the charters of companies operating in English cities.

Subscriptions are now being received for the stock of the Citizens' Gas Company, which is to be formed to operate under the franchise granted to three representative citizens, two of them being the presidents of the Commercial Club and the Board of Trade, and selected on this account.

It is the intention in the incorporation of the new company to correct the few errors found in the Consumers' Gas Trust Company's charter and to add a few provisions which have been found useful in other countries.

All the provisions in the new franchise have been tested elsewhere or are attempts to correct errors in former franchises. The following references to sources of the various provisions may be made:

The capital stock has been fixed at not less than $1,000,000. Since the stock must pay 10 per cent. interest before repayment thereof can begin, this provision might have been a little more flexible in order to permit reduction in fixed charges by issuing bonds at a lower rate of interest for as much of the cost as possible.

The provision for sale of additional stock at auction when increase in capitalization is made is taken from English practice where it is reported to be successful in preventing the watering of stock by means of stock dividends or otherwise. The annual publication of accounts provided for is also required in some English cities and is frequently recommended in this country as one of the best methods of control of the financial operations of public-service corporations.

The provision of the self-perpetuating board of trustees was taken from the franchise of the Consumers' Gas Trust Company, in which it has operated very successfully, the first choice of board of trustees having been well made and the vacancies occurring from time to time having been equally well filled. The provision for removal of members of the board by the Circuit Court for conduct affecting their integrity or their relations to the company through their relations to other companies or persons in the same class of business probably is sufficient safeguard of the membership of the board.

The restriction of dividends to 10 per cent. is also taken from the former franchise, the rate being raised from 8 per cent.; also the repayment and extinguishment of stock from surplus after matured debts, operating expenses, dividends, current and accrued, and extensions and betterments ordered by the Board of Public Works have been provided for. Stockholders receive dividends only on the remainder of the stock after partial repayments have been made, and when they have been fully repaid they must surrender their stock for cancellation, the plant must be turned over to the city and the corporation wound up. Since the city is to receive the plant when the stockholders have been paid, the provision giving the Board of Public Works the

control of the amount of extensions and betterments up to 10,000 feet of pipe a year will probably not be misused. If the board delays the repayment of stock by reducing the surplus on account of its demands for extensions, it extends the time during which the stockholders will receive the 10 per cent. interest and postpones the date at which the city will receive the plant, free of such interest charge. It has been suggested that the provision regarding the turning of the plant over to the city is too near that in the Consumers' Gas Trust Company's franchise for safety and that an agreement made by all stockholders to transfer their stock to the city when they have been fully repaid would prevent any such litigation as that concerning the Consumers' Gas Trust Company, the decisions in which have been adverse to the proposed transfer to the city. The only difference to the layman in the two is that in the Consumers' franchise the city was given the right to purchase the plant at any time at an appraised value, while in the Citizens' Gas Company's franchise it must be transferred to the city, without any cost thereto, when the stock has been fully repaid, with interest.

The management of the business of the company by a board of directors elected by the board of trustees is also taken from the earlier franchise.

A new provision is that requiring the board of directors, upon notice from the city Board of Public Works at the end of the period of the franchise, twenty-five years, to borrow at not exceeding 6 per cent. interest enough money to complete the repayment of stock and to turn the plant over to the city subject to this and any other indebtedness which the plant may have. This provision affects the ordering of extensions by the Board of Public Works, since inordinate demands for such extensions will increase the indebtedness which the plant must carry when it is turned over to the city.

The gas must contain 600 heat units per cubic foot. The rate charged must not exceed 60 cents a thousand cubic feet. The city may purchase the plant, if the company becomes insolvent, on payment of its indebtedness and the balance due the stockholders.

The provisions regarding extensions on petition of property owners, methods of construction, inspection, indemnity bonds, limitations of time of various acts and constructions, etc., are the same as those in other franchises granted by the city, with such modifications of details as were needed to meet the specific conditions.

SPECIFICATIONS AS TO EFFECT OF WATER UPON ASPHALT.

By Andrew Rosewater, City Engineer, Omaha, Neb.

In reference to Mr. Dow's criticism of "Effects of Water on Asphalt" in the October issue of MUNICIPAL ENGINEERING it may be said first that there is no occasion for pique or personality on his part. In the examination of Washington pavements last fall the general prevalence of brick gutters was commented on by the writer, and Mr. Dow, in explanation, stated that for six years past brick gutters had been required. No questions were asked as to the reason. The Washington specifications call for eighteen-inch brick gutters. Such a width could not preclude vehicle wheels from sinking into pavements when soft, nor prevent the distortions due to horses' hoofs when standing. The natural inference was that brick was used to avoid the effect of moisture.

In my own experience gutters of brick or stone on concrete have been specially designed for localities where horses and vehicles are constantly hitched, such as large office buildings, or where, owing to steepness of grade, it has been considered desirable to provide better footing for horses on part of the roadway during sleety weather. Mr. Dow states that such construction in Washington was not advised by him; on the contrary, he advised asphalt from curb to curb. That being so, his explanation is entitled to acceptance without further discussion and, so far as that feature of criticism is concerned, is dismissed by the writer.

The greater portion of Mr. Dow's criticism is devoted to a defense of that feature of the Washington specifications which reads: "If an asphaltic cement is accepted that is affected by water some provisions satisfactory to the engineer commissioner must be made to guard against the result of such action, and such work must be included in the price bid for."

Concerning that class of provisions the writer stated, in treating of "Factors in Asphalt Construction:" "From practical contact with the varied features of this question I am led to regard specification

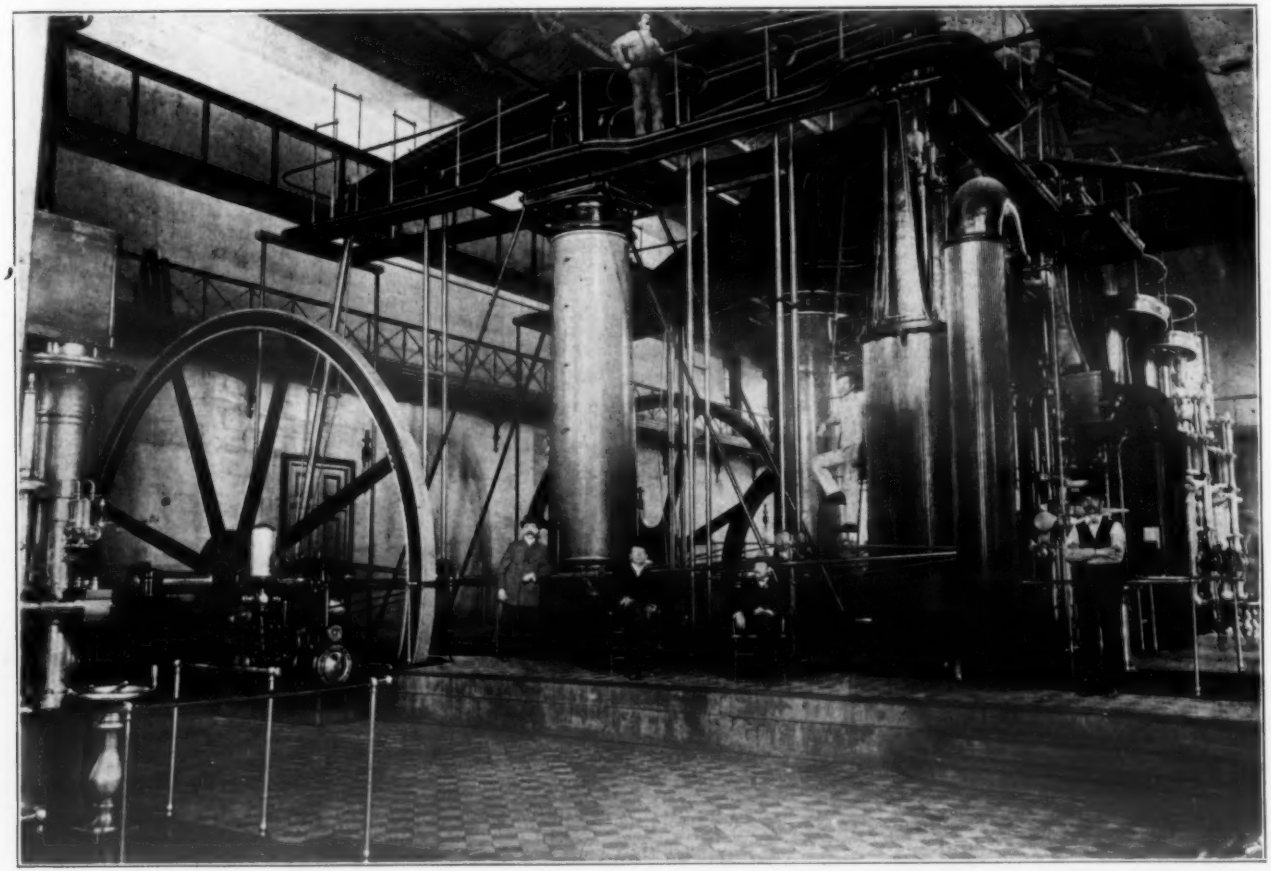
provisions placing power in boards or officers of boards to discriminate on grounds of the above nature as far more dangerous to the honest public service than any possible shortcoming affecting longevity of pavements from such alleged defects."

This clause, as Mr. Dow admits, was designed in sugar-coated language to exclude Trinidad asphalt from use as a paving material. Such exclusion, in my judgment, would be on par with the attempted exclusion years ago of all asphalts except those from lake deposit on the island of Trinidad by similar specification. The writer, when Mr. Dow was still in the regular employ of the old Barber Asphalt Paving Company, made vigorous opposition to such provisions and was engaged for nearly a year in the courts, fighting injunction and other suits intended to perpetuate monopoly in paving by limiting the use of asphalt to one single source exclusively. At that time the writer stated that good and bad pavements had been laid with Trinidad asphalt, and the successful laying of an asphalt pavement depended upon many features of physical construction as well as of the ingredients of asphaltic cement. He expressed his belief then, and it has come true since, that the development of open competition would be an incentive to the study of the factors governing asphalt paving construction and result in the laying of good pavements with the asphalt from the numerous other sources than Trinidad. He emphasized his claims by citing the failure of a pavement laid with Trinidad lake asphalt in Paris in 1886, saying that it was doubtless due to the lack of a proper formula for the traffic conditions in that city. Since that time, after several more failures abroad, Mr. Richardson succeeded in laying pavements in both Paris and London to meet the traffic, as well as the moisture, conditions of these cities with Trindad asphalt.

The requirements of a traffic of 450 tons per hour per foot width of roadway on Fifth avenue, in New York, have also been successfully overcome with a properly constructed Trinidad asphalt pavement. As a result of open specifications asphalt mines have been developed in numerous localities and good pavements have been and are being laid with asphalts from California, Venezuela, Cuba, Utah, Kentucky and other localities. In the face of these results it would be demagogical and absurd to reverse the levers and exclude Trinidad asphalt, which has been successfully used upon fully 75 per cent. of the pavements laid in the United States and upon the popularity of which the present demand for asphalt pavements has been developed.

From personal knowledge and investigations the writer knows of poor and bad pavements resulting from each of the various asphalts used in paving, and before concluding on a sweeping condemnation of any asphalts extended and intelligent investigation should be made of the proportion of paving mixtures used in each particular case, their method of production and construction and local surroundings and conditions. Special instances have been cited by even Mr. Dow of disintegration setting in on a section of Bermudez asphalt pavement, due, as he states, to exposure to moisture from beneath and at the sides. Because of such instances it does not follow that Bermudez asphalt is unfit for paving purposes. It is barely possible that in that case, with a proper mixture with suitable sand, grading and filler, no effect whatever would have been produced. The fact that Trinidad and Bermudez pavements applied to London streets, the one in 1894 and the other in 1895, both failed, and that in 1897 a pavement of Trinidad asphalt was laid which is reported as still in good condition, seven years later, proves that the remedy lies in proper proportioning of mixtures and proper construction rather than the condemnation of the asphalt used. Asphalt, as it exists in the paving combination, can by no means be compared in making tests to the asphalt used by itself. A California critic, in the same issue of the magazine in which Mr. Dow's article appears, in unnecessarily defending California asphalts by citing a case wherein it has been used successfully under water as a reservoir lining, might ascertain by correspondence of the failure of Trinidad as well as California Alcatraz asphalts as reservoir linings at the Denver water works some year ago, and it is barely possible that here, as in paving cases, the fault may be due to improper methods of construction rather than to the materials.

If, as Mr. Dow claims, the discovery has been clearly established that Trinidad asphalt is so susceptible to the action of water that it is unfit for paving purposes, why not openly state in the specifications that its use will not be permitted, instead of leaving it to the discretion of an engineer or other official to admit its use, if satisfactory provisions can be made to overcome the effects of moisture. If, as this specification intimates, this weakness can be overcome, why not specify how it is to be done. Mr. Dow admits that all asphalts are susceptible, when combined in paving mixtures, to the disintegrating action of water. That being so, it is simply a question of degree, and, if a question of degree, to what is the



I. FIRST PUMPING ENGINES OF CHICAGO WATER WORKS, 1853 AND 1857.
Capacity, 8,000,000 and 13,000,000 gallons a day.

weakness due? It has been shown that the grading of sands and the use of proper kind and proportion of filler will make a pavement mixture impervious or nearly so, to moisture. Physically, by providing for sub-drainage and surface drainage through a well-crowned street and properly compacting the materials, excellent pavements can be laid with Trinidad as well as asphalts from various other sources, and have been and are being laid.

To develop these requisites is the province of the engineer. It has been urged that some asphalts, particularly those from Trinidad, are affected more quickly than others when subject to moisture, and that moisture often comes from underneath, and in such cases more readily attacks Trinidad asphalt than others. All this is specious argument. Water and frost are the great natural destroyers of pavements, whether they are stone, brick or asphalts. Every text book on foundations, whether of buildings or pavements, urges proper sub-drainage and drainage. This is fundamental with macadam and even earth roads. Mr. Dow quotes what Mr. Richardson wrote eleven years ago, notwithstanding he has publicly written and proclaimed a change of views since making more extensive investigations, and demonstrated the logic of his conclusions by practical results.

The writer recalls hearing Mr. Dow testify in favor of Trinidad lake and against Trinidad land asphalt at Peoria, Ill., in 1895. Several years later Mr. Dow published an extended article expressing a change of views and indorsing Trinidad land as against Trinidad lake asphalt, and still more recently he has concluded that neither is fit for paving.

In the making of specifications he has changed with even greater rapidity, and yet the writer does not wish to be understood as criticising Mr. Dow for a change of views. On the contrary, if based on honest investigation and the conclusions are sound and logical, he is commendable for them. In his criticism of the writer for opposing the "exclusion clause" Mr. Dow says: "Mr. Rosewater, from his remarks, appears to be considerably wrought up over the fact that some cities in the country have clauses in their paving specifications giving preference to asphalts that are not readily affected by water, and even goes so far as to suggest, by the tone of his remarks, that such a clause is used for dishonest purposes." The truth is that Mr. Rosewater had good reason to not alone believe, but to know of the use of such provisions for dishonest purposes. In the city of Omaha he has seen the controlling majority of a board of public works play into the hands of a corrupt combination, not only allowing exclusive control of contracts, but occasioning the payment of 30 per cent. more than was paid without the use of such a clause, and accepting the work even of such contractor without fulfilling the specification requisites, in the face of analyses made at Washington and elsewhere. This same contracting influence had work accepted and paid for which was 25 per cent. deficient in the required bitumen.

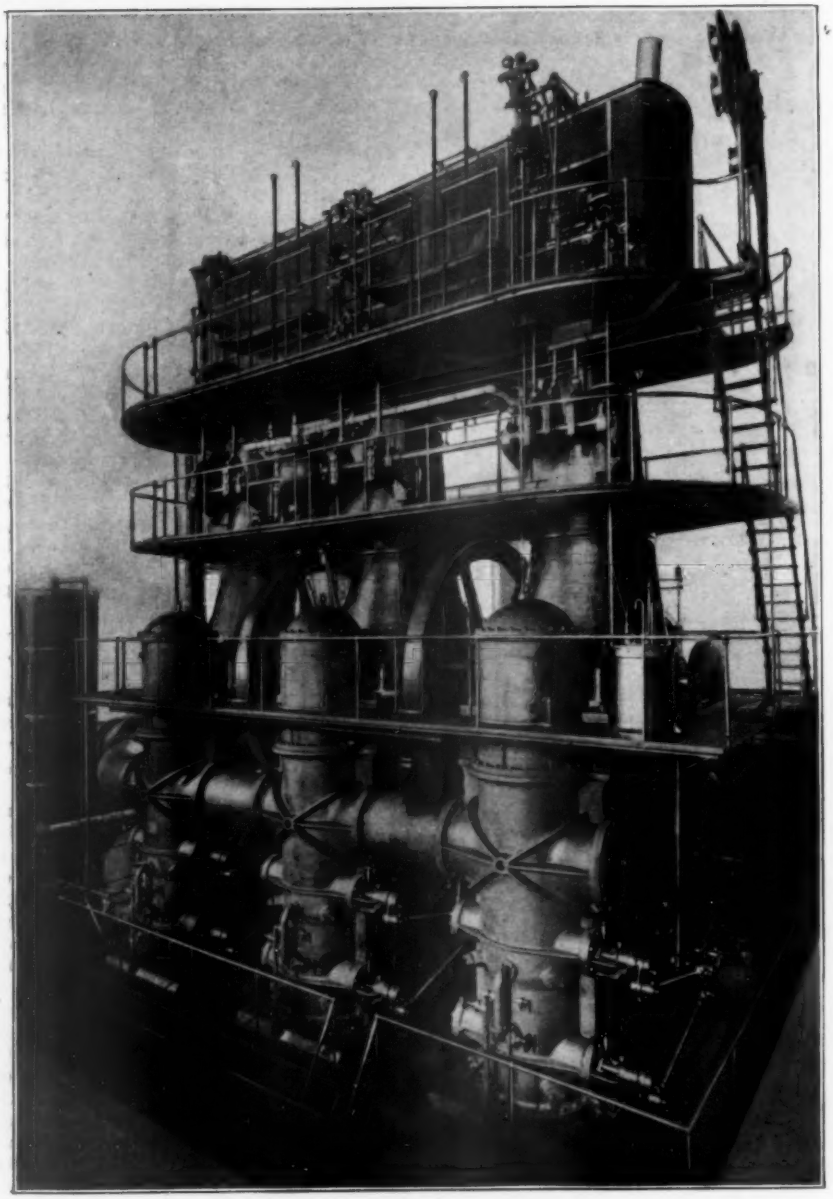
The specification clause may do well in Washington, and I wish distinctly to disavow making or intending any charge of insincerity or dishonesty on the part of the officials there, but that class of specifications forms the basis of a very large amount of crooked deals in municipalities as they are usually organized. Placing discretionary power of that kind in the hands of ignorant, unscrupulous politicians who are temporarily intrusted with public work opens the way for successful hold-ups, but does not protect the public against poor or improper material.

Mr. Dow, whilst criticising the use of Portland cement as a filler, does so from purely a conjectural point, and not because of any physical or chemical reason. He admits it may have been found effective with Trinidad or Bermudez, but it hasn't been tried with other asphalts, and, being dearer than powdered limestone, condemns its use. Such conclusions, in the face of successful practical experiments, are unworthy of a man having the professional standing of Mr. Dow. Referring to his intimation of greater cost, the article criticised expressly states that the cost is increased by the use of Portland cement, but is so trifling as to be justified by the better results.

The criticism by Mr. Dow that specifications requiring not less than 60 per cent. of the bitumen in the asphalt used to be soluble in petroleum naphtha excludes some Cuban asphalt and also Gilsonite, is possibly well founded and should be improved by suitable modification.

In conclusion the writer desires to state that his article was by no means presumed to be perfect or free from faults, for certainly where so many eminent expert chemists differ so widely from one another on technical features it is not to be expected that engineers who make no claims as chemical experts will be free from the charge of error in dealing with these features.

EDITORIAL NOTE. This article has been referred to Mr. Dow for his comments, which are not received in time for insertion here. They will be found on a following page.



II. LATEST PUMPING ENGINE.
Capacity, 25,000,000 gallons a day.

THE WATER SUPPLY OF CHICAGO.

The city engineer of Chicago, Mr. John Ericson, has recently made a special report upon the past, present and future of the water supply system of Chicago, which contains a condensed history of the works, a statement of the improvements which are now under way and some of the plans for future extensions.

The first water works system in the city was constructed by a private company in 1836, and the city became the owner of the works in 1851. A pumping engine of 8,000,000 gallons daily capacity was erected in 1853, and another in 1856 of 13,000,000 gallons daily capacity. These engines are shown in one of the accompanying photographs, for which we are indebted to City Engineer John Ericson. A third engine of 18,000,000 gallons capacity was added in 1867, and a fourth, of 36,000,000 capacity, in 1872. Two 12,000,000 pumps were added in 1887. These pumps will soon be replaced by three vertical triple expansion engines, each with a daily capacity of 25,000,000 gallons. One of these engines has been installed, and is shown in the second of the accompanying photographs. A second will be ready for use this year, and the third is under contract. The third photograph shows the north pumping station, which contains these engines. The building shown was constructed in 1869.

The fourth plate contains a group of photographs of the various pumping stations now in operation. The first station, as stated above, was the North, or Chicago avenue, pumping station, first established in 1851, and replaced by the present station in 1869. It has now 66,000,000 daily capacity, and with the completion of the new pumps will have 75,000,000.

As the city grew south and west it became difficult to sustain water pressure in the distant sections of the city, and the West pumping station on Ashland avenue, near Twenty-second street, was installed in 1874, with two engines, each of 15,000,000 capacity. This was increased by two similar engines in 1882, making the total capacity of the station 60,000,000 gallons a day.

These two stations took their supply from a short tunnel out into the lake. The Chicago avenue crib is shown in the group on the fifth plate.

This tunnel was outgrown in 1887 and a new tunnel system was designed connecting with the Harrison street station, with two pumps together of 36,000,000 gallons daily capacity, and the Fourteenth street station, with three pumps and 54,000,000 gallons daily capacity. The four-mile crib to supply the increased demand was completed in 1892.

When the city of Lakeview was annexed to Chicago it had a system of water works which was rebuilt, and now has a capacity of 45,000,000 gallons, with three pumps. The Lakeview crib was completed in 1896, and is two miles from shore. Photographs of the handsome pumping station and of the crib are included in the groups on Plates IV and V.

When Hyde Park and Lake were annexed they each had pumping stations on Sixty-eighth street, which were combined in the Hyde Park station. The Hyde Park station had 18,000,000 gallons daily capacity, and the Lake station 23,000,000. The combined Sixty-eighth street station now has ten pumping engines, with a total daily capacity of 82,000,000 gallons. The supply is taken from the Sixty-eighth street crib, about two miles from shore.

Washington Heights, when annexed in 1890, had a deep well system, but is now connected with the Sixty-eighth street system, repumping 2,500,000 gallons a day to supply the water at the pressure necessary in the high territory about the station.

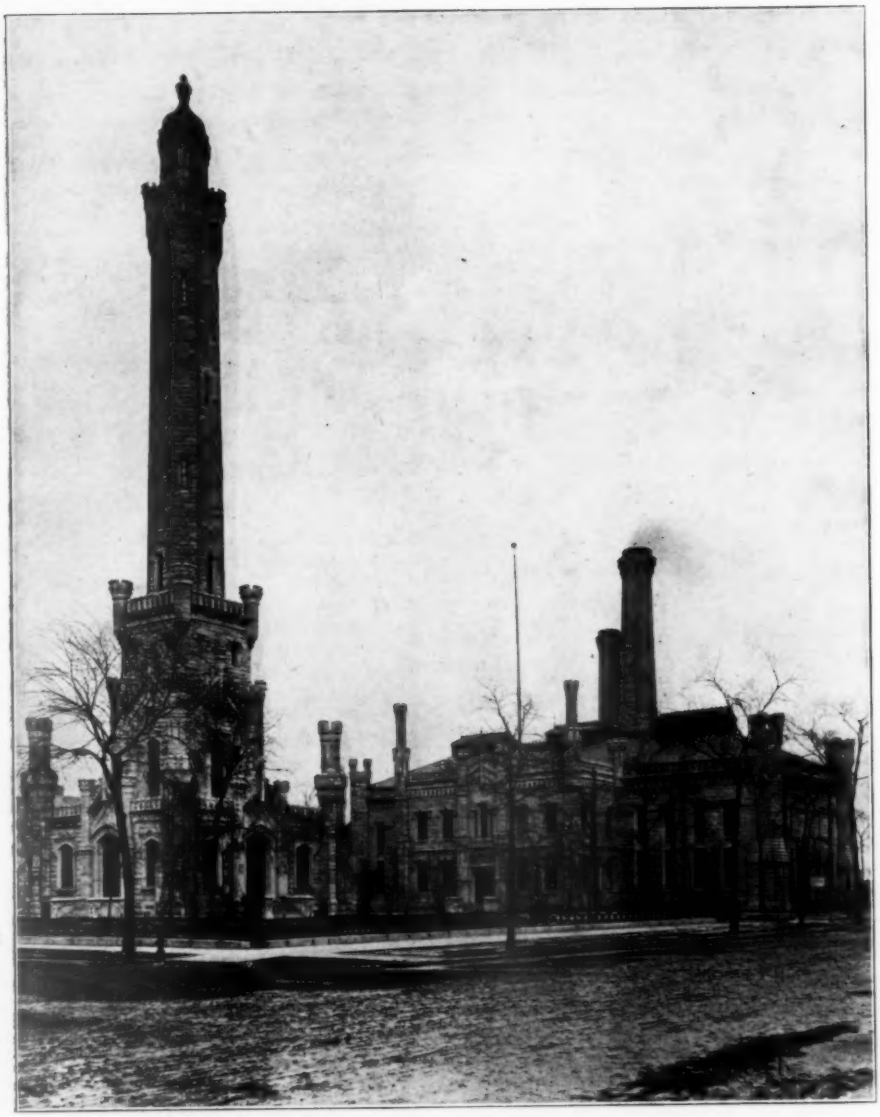
The Norwood Park station was a similar problem. It now has a capacity of 1,000,000 gallons daily.

Since 1897, under Mr. Ericson as city engineer, many improvements have been made, two new pumping stations have been constructed and new intake cribs and tunnels.

The new pumping stations are the Central Park avenue station, with 60,000,000 gallons capacity, and the Springfield avenue station of the same capacity. Both of these stations are shown in the group on Plate IV, and the detail of the Springfield avenue station is more fully shown in the large photograph, Plate VI. The water for these stations is taken from the lake through the Carter H. Harrison crib, four miles from shore, which is shown in Plate V and Plate VII.

The present pumping capacity of all the stations together is 494,500,000 gallons a day, the net available capacity constantly being about 370,000,000 gallons. Improvements are authorized and under way which will increase this capacity by 1907 to 637,100,000 gallons, and the new Roseland system, on the South Side, when completed in 1910, will add another fifty million.

The ten pumping stations and five intake cribs supply water for 1,978 miles of mains, 20,349 fire hydrants and 220,000 taps, of which but 8,102 are metered. There are thirty-eight miles of tunnels to supply the various pumping stations with water.



III. CHICAGO AVENUE OR NORTH PUMPING STATION.
Erected 1869.

PROGRESS OF AMERICAN MUNICIPALITIES.

Committee Report to American Society of Municipal Improvements.

By Charles Carroll Brown, Chairman, Indianapolis, Ind., and T. Chalkley Hatton, Wilmington, Del.

The report of the committee on review was presented in two parts. The part presented by the chairman was devoted to an exposition of the diversity of methods of making municipal reports and their ineffective nature in nearly all cases. It was found that at least five cities of more than 25,000 population do not publish annual reports, those so stating being Dayton, Denver, the New Orleans municipal departments, Omaha and Seattle. There are doubtless many of the smaller cities which, like Elkhart and Kokomo, Ind., do not publish reports. Twenty-two cities sent reports and fifty-nine did not.

Several of these reports were analyzed, showing their useless nature in many instances, and it was also shown that there is seldom more than one department in a city which makes a really good statistical report and that no two cities hit upon the same department for such detail or use the same or even approximately the same forms for these reports.

None of the cities use the standard forms adopted by this society, except the Cleveland waterworks department, which uses the standard form for waterworks reports.

The report calls attention to the "group plans" which have been proposed for Cleveland, St. Louis, New York and Indianapolis, and to the increasing desire among the people for greater unity in design of cities. The development of commissions for making these plans and for supervising all plans for public adornment, like the Municipal Art Commission of New York, but with greater powers is commended.

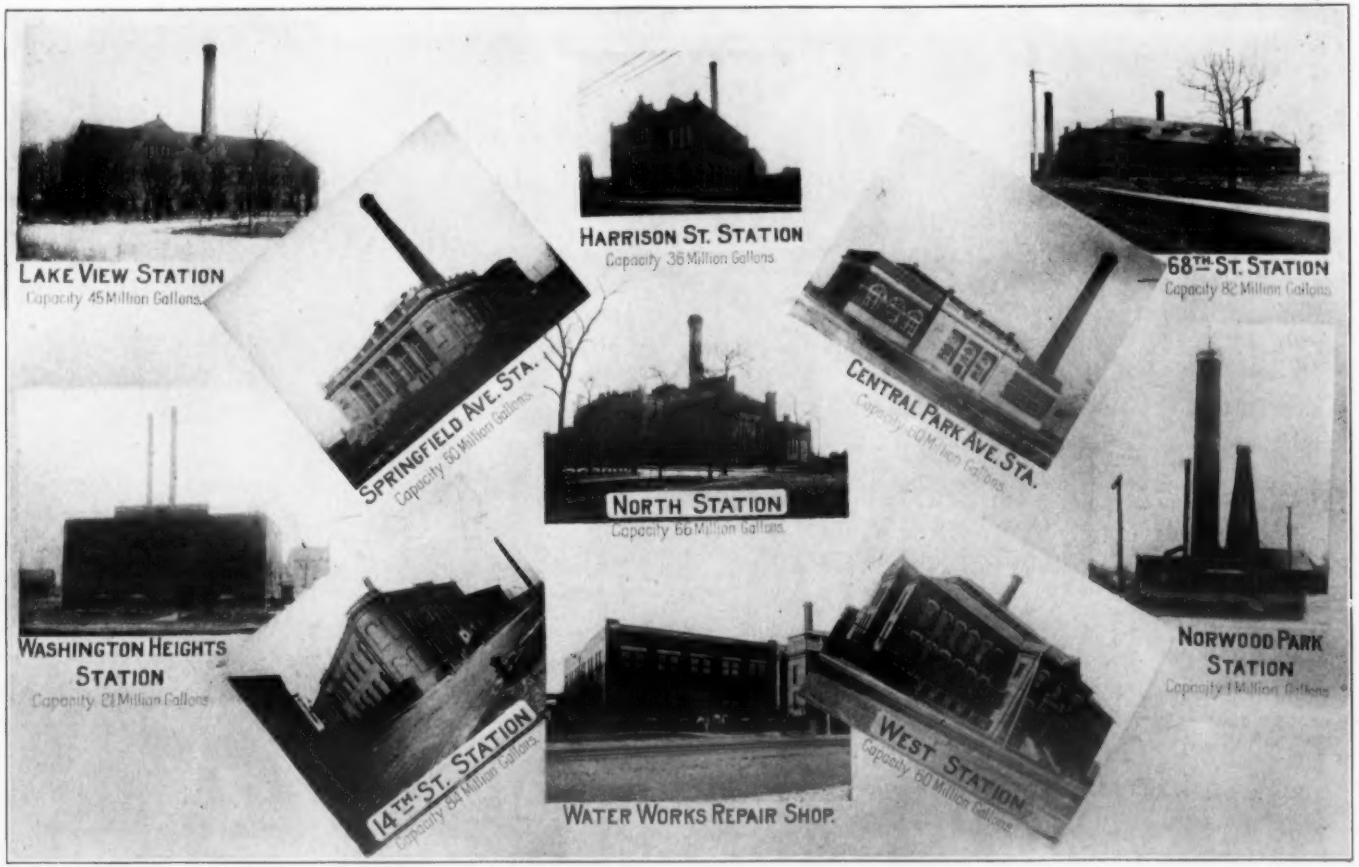
The part presented by Mr. T. Chalkley Hatton reviewed municipal work in the Atlantic States since 1880, as follows:

The municipal improvement of first importance has been the development and construction of public water supplies, and the measures taken for supplying pure water and protecting the sources of supply against possible pollution. In 1900 there were 656 cities and towns in the Atlantic coast States having a population of 3,000 or over which had public water supplies, now increased to 693 plants. Most of these plants have been largely improved by extensions to the distribution systems, enlarging the reservoir capacity, purifying the water. Since 1880 there have been built 151 water purification plants in the Atlantic coast States. The greater number of these plants have been constructed for water works which are operated under franchises, apparently indicating that communities are much more particular as to the quality of the water used when it is supplied by private interests than they are where they have to pay the bill for purification methods themselves. The greater number use the mechanical filtration process, and a few the slow sand process, coagulation, sedimentation, filter cribs and softening processes. The largest plant is at Philadelphia, Pa., and the next in size is that at Washington, D. C. These plants are built upon similar lines, being the most improved type of slow sand purifiers. The class of work done at both plants is as fine as the writer has ever examined, and in spite of the investigation now going on in the Philadelphia plant it seems certain to the writer's acquaintances, who have carefully examined the plant, that but few flaws will be found in the construction, or in the materials used. The cost of this plant to date has been about $22,500,00, and it is estimated that it will require about $4,000,000 additional to complete it. The minor portion of the filters are already in use, and are supplying a portion of the city with reasonably pure and wholesome water from a highly polluted source. A large portion of the Washington filter plant has been completed, but only part has been put in operation.

Among the large water purification plants in the East might be mentioned the one which filters a portion of the New York City supply, Boston, Albany, Lawrence, Binghamton, Elmira, Poughkeepsie, Hoboken, Paterson, Allegheny, Chester, New Castle, Wilkesbarre, York, Norfolk and Atlanta. One of the most recent and best equipped mechanical filter plants is the one at Little Falls, New Jersey.

Twenty years ago the average citizen of this country looked upon typhoid fever as a punishment sent by Providence which could not be avoided but must be endured. Now, however, the most ignorant have a well fixed idea that the disease can be easily prevented by protecting themselves against an impure water supply.

The improvements made to the sources of water supplies during the last decade have been numerous. For instance, the



IV. CHICAGO'S PUMPING STATIONS.

large impounding dams built by the city of New York for insuring a supply of water during dry weather can hardly be duplicated anywhere in this country. The system of impounding reservoirs built by the city of Boston to preserve its water supply are good examples of how the American cities are providing for their future water supplies, while many minor cities of Pennsylvania have built impounding reservoirs of much magnitude, few of which are ever described in technical journals.

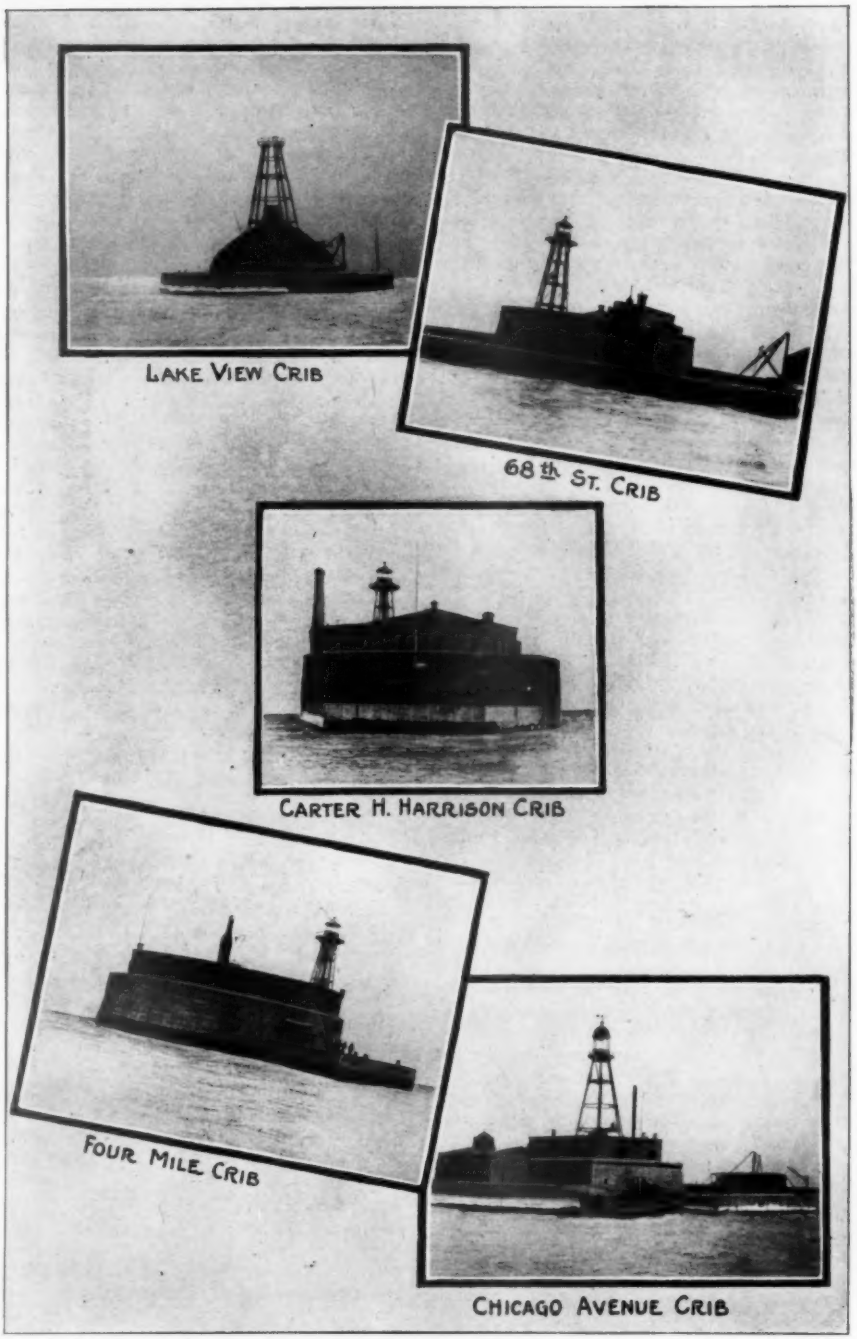
Coincident with the purification of water has been the proper disposition of sewage and sewerage systems of great magnitude, and costing enormous sums of money, have been constructed. Prior to 1880, with but few exceptions, sewers were primarily built by cities and towns for carrying off the storm water, and, incidentally, they were used to carry off the liquid household and manufacturing wastes. The writer has knowledge of eight of the larger towns one a city of over 300,000 population, which, up to a few years ago, prohibited by ordinance the discharging of any sewage into the sewers of the municipalities. Few sewer systems were designed as an intelligent whole, but were mostly designed and constructed for the immediate needs. The larger cities carried the storm water and sewage through the same conduits to the nearest available natural water course, which soon became merely an open sewer, polluting the atmosphere in its vicinity, and frequently the domestic water supply of a neighboring city further down the stream.

For some years past, however communities have been realizing that the primary use for sewers is to carry off underground the liquid wastes, and that it is the duty of those contributing to so dispose of it that it may neither become a nuisance to themselves nor to their neighbors, and that the disposition of the storm water is of secondary importance. The result has been that sanitary sewers have been built in all the larger Eastern cities to a greater or less extent, so as to afford all the inhabitants ample sewerage facilities, and the smaller towns and villages are rapidly following suit. In fact, it is the exception at the present day to find a town of 3,000 population or over in the Atlantic coast States where sewers have not already been constructed or a system is being strongly talked of. From the indications suggested by the replies to his circular letter sent to the several Eastern cities, the writer believes that there have been more miles of sewers built in Eastern cities since 1890 than water mains, and that the money expended for them has been of larger amount than for any other municipal improvement, except street pavements.

So far as the writer has been able to learn, there have been constructed since 1880 in the cities of the Atlantic coast States eighty-three municipal plants for the purification of sewage, or more than one-half as many sewage purification plants as domestic water purification plants. In the early days of sewage purification in this country the process most generally used was intermittent filtration, and several large and fairly well operated plants were constructed on these lines. There are thirteen of such plants in operation in Massachusetts alone, the largest of which is the one at Brockton. For a time chemical precipitation was a popular method of disposing of sewage, and several such plants were constructed in the New England States and in New York and New Jersey. The largest plant in existence in this country, if not in the world, is the one at Providence, R. I., which has recently been completed, and which provides for the purification of all the sewage from the city and the first washings of the street surfaces. The chemical precipitation plant, which has no doubt contributed the most information to the United States upon that process of purification, is the one at Worcester, Mass., which has been intelligently operated for a number of years. Among the larger sewage purification plants in operation in the Eastern cities might be mentioned those in Clinton and Marlboro, Mass., Central Falls, Pawtucket and Woonsocket, R. I., Meriden and Danbury, Conn., Kingston, New Rochelle, New York City and White Plains, N. Y., Long Branch and Plainfield, N. J., Altoona and Reading, Pa., and Wilmington, N. C.

The process which in recent years has become the most popular is the septic tank, with or without subsequent filtration through contact beds, sand or ground. So far as the writer has been able to learn, there are at the present time some thirty-eight such plants under construction in the East. The cheapness of construction and operation has appealed to the average city father, hence the great popularity of this process.

The major portion of sewage purification works have been constructed in Massachusetts, Connecticut and Rhode Island, owing, no doubt, to the dense population, and the abundance of surface water supplies. The States of New York, New Jersey and Pennsylvania are rapidly coming to the front, however, and are insisting that crude sewage cannot be discharged into the natural water courses of the States. Excellent laws have re-



V. CHICAGO'S INTAKE CRIBS.

cently been enacted in these three States, which make it obligatory upon a municipality to purify its sewage by some approved method before dumping it into the streams, and within a few years the writer believes there will be but few cities and towns in these States which do not practice sewage purification. The question has not yet been seriously taken up in the Southern cities, for the reason, no doubt, that the population is much less dense and sewerage systems are just being constructed, but the Southern cities are making rapid strides in municipal improvement.

More of the public's money has been expended in securing improved street surfaces since 1880 than for any other municipal purpose. Hundreds of miles of granite block, fire brick, sheet asphalt and bituminous macadam have been used, laid upon all kinds of foundations and costing millions of dollars. Of these several classes of materials mentioned, granite blocks have been used where the traction is heavy and upon a restricted area; sheet asphalt in the retail districts of a city and in some of the residential portions; bituminous macadam and fire brick have been principally used in the residential sections. Aside from these permanent pavements, many miles of macadam and telford roadways have been constructed in suburban districts. From information received from the several cities heard from, the cost of several classes of pavements referred to, except bituminous macadam, which is a comparatively new class, is about 30 per centum less than it was in 1890, although the cost of labor has materially increased since then. In the writer's judgment, the decrease in cost is due to the manufacturer and producer taking less profit for his goods and the contractor less profit for his labor.

Prior to 1880, the cleaning of the streets of our Eastern cities was a spasmodic occurrence usually during the day, when those whose duties kept them upon the streets usually received large volumes of the dirt and dust stirred up by the brooms. But now the streets are regularly and systematically cleaned so as to be of as little nuisance to the citizens as possible. Prior to 1880, every city of any size in the East had its slums. The municipality did not seem to realize the duty it owed to itself to look after the cleanliness of this district, and the streets were poorly paved, if paved at all, more rarely cleaned and poorly lighted. Now that the authorities recognize the fact that they are protecting the health of the whole community by making the surroundings of those who must necessarily live in the slums as clean as possible the result has been that but few of the old-fashioned slums can at this time be found in any of the larger Eastern cities. And some have even gone so far as to exercise a judicious supervision over the interior of the homes of this careless class, compelling cleanliness. This condition has been brought about largely by philanthropic work but the conscientious city officer has had his just share in it by first providing sewers, street paving and lights to these districts, and thus educating the inhabitants in a practical manner how their conditions might be bettered.

One of the greatest improvements in municipal affairs since 1880 has been the lighting of the streets. Prior to 1880 there were but few electric lighting plants in the United States, most of the street lighting being done by gas or coal oil, and even these lights gave little illumination, and going through the streets of a city at night was not much better than traveling on a country highway. Since 1890, however, cities and towns, and nearly every village of the Atlantic Coast States are lighted to a greater or less extent by electricity, and the majority by arc lights of large candle power. To give an idea of how the business of electric lighting has grown since 1890, the writer takes from his replies received from the cities written to the following information:

One city, which in 1890 had 1,125 arc lights, now has 3,731.

One city, which in 1890 had 195 arc lights, now has 2,800.

One city, which in 1890 had 50 arc lights, now has 989.

One city, which in 1890 had 94 arc lights, now has 811.

One city, which in 1890 had 587 arc lights, now has 1,906.

One city, which in 1890 had 149 arc lights, now has 329.

The cost of lighting with electricity has decreased about 30 per centum since 1890, and a still further decrease is expected.

For many years the maintenance of the wires upon poles throughout the densely populated cities was a menace to life, as these wires carried a deadly current and were constantly liable to be broken and come into contact with man or beast; but since 1890, in most of the larger cities and in many of the smaller ones, these wires have been placed underground in conduits, built either by the companies owning them, or by the municipalities and rented to the companies. For instance, in Washington, D. C., no wires are allowed to be strung above ground or over the streets and in many sections of New York City, Philadelphia and Boston the same is true. Baltimore has for years been constructing an intricate system of

VI. THE NEW SPRINGFIELD AVENUE PUMPING STATION, CHICAGO WATER WORKS.

conduits for carrying the wires and will soon have it completed. It is, perhaps, the best sample of a conduit system in existence in the Eastern cities.

Co-existent with electric lighting is the electric railway system of the Eastern cities. In 1880 there was no such thing as a "trolley car," and those who traveled by public conveyance through the streets of a city were forced to patronize the now unfamiliar horse or mule tram car, still sometimes seen in New York City, Now, every city and town has its extensive trolley system. And the trolley car has been relegated to the rear in some larger cities where distances have become great, and the rapid transit subways are the thing of the present and future. The Boston subway is the first venture in this line in this country, and is a magnificent sample of engineering. The usefulness of this property was soon made manifest to the city officers of all large cities, and within a few years after Boston's venture New York City constructed the first portion of its subway system, through which a pasenger is carried through or under the city as rapidly as though he was out in the country districts. The New York subway system has just been begun, and its extensions as outlined at the present time will cover a great portion of the island and reach into Brooklyn. The engineering feats accomplished and the obstacles overcome in the successful building of the New York subway have never been paralleled in the world, and for many years to come it will stand forth as the most tremendous undertaking of any municipality in the world, for it is a purely municipal undertaking, built by the city of New York and leased for a term of years to the present operators. The subway at Philadelphia is being rapidly built, and although a large and expensive piece of work, is but a simple proposition when compared with the New York subway, and, unlike the latter, is being built by a private corporation, and, for the present time at least, with a view only of assisting rapid transit on Market street, the principal thoroughfare of the city, where more street cars run on the surface per hour than upon the street of any other city in America. The city of Pittsburg is now contemplating giving franchises for the construction and operation of an underground subway for electric cars, and by the end of another decade we may expect to go to our suburban homes by means of underground railways instead of by surface tracks.

A much needed municipal improvement, which has not kept pace with the rapid development of the cities of the East, is the proper disposal of the garbage, and there is perhaps no question to-day which is giving the municipal officer more concern than this very system. For several years past many systems of disposing of the garbage of cities have been introduced and tried with some success. These systems have been patented by the several inventors, many of whom know little about the matter, and, as a whole, they are conceived, built and operated upon purely unscientific methods. So far as the writer knows, there are at present being operated eighty-eight plants in as many cities of the Atlantic coast States for the reduction, cremation or other artifical disposition of garbage. Some of those he has visited are performing the work in a fairly successful manner, but the majority seem far from perfect. It seems that there is a wide field for the scientific and sanitary expert in garbage disposal, and many cities in the writer's knowledge would welcome the introduction of a garbage plant that could be relied upon to perform the services required with a reasonable expense. From data secured from the several plants visited by the writer at various times, there is no uniform ratio between the amount of garbage disposed of and the cost per ton. This may be largely the result of ignorant management of the plants, and not so much from the design of the process, as it has occurred to the writer that the most inefficient class of labor is employed in this work. As the cities grow the garbage increases and the question becomes more serious, and but few cities in the East have met it squarely.

The bulk of municipal improvements in the Atlantic coast States has been in the New England States. New York follows closely and New Jersey and Pennsylvania are not far behind. Maryland and Virginia are getting into the procession, and the Carolinas, Georgia and Florida are just beginning, but the fever is there, and in another decade the South will be able to offer the home-seeker just as comfortable surroundings as can be found anywhere upon this continent. To the writer it seems that public progress has kept pace with private improvements, in spite of the handicap which politics always places upon it.

VII. THE CARTER H. HARRISON INTAKE CRIB, CHICAGO WATER WORKS.

MUNICIPAL FRANCHISES.

Report of Committee of American Society of Municipal Improvements.

By James Owen, Montclair, N. J., and John R. Barlow, Montreal, Que.

To properly appreciate the gradual growth of the franchise problem it will be proper to note the specific items for which municipal franchises or charters have been asked and granted, and how they have been granted.

It is further interesting to an engineer to note that the items that can be properly included in the franchise problem are subjects of engineering investigation, so it is therefore not improper for an engineer to give them careful consideration, instead of leaving them, as it is usual, to a lawyer.

It must be understood, also, that it would be practically impossible for one man to keep track of all the ramifications of the franchise problem in this continent, and specific allusion will be made to the section with which the writer is most intimate, viz.: the metropolitan district of New York. But with its immense population, with different States and different municipalities, the varied practices of that district may be taken up as a sample of the whole.

The particular items for which municipal franchises are granted are: Turnpike roads, water, canals, steam railroads, gas, horse car roads, steam heating, electric light and power, telephone, electric roads, surface, elevated and depressed.

Steam railroads and canals are interwoven with municipal growth, and the steam railroads are becoming more subject to municipal jurisdiction, in the readjustment of lines and grades to the development of a city or town, and in the constantly increasing extensions demanded for the collection and distribution of people.

Four of the items can hardly be considered as live subjects, viz.: canals, turnpike roads, horse cars and steam heating.

It can be noted that the crucial point of municipal franchise granting was coincident with the introduction of electricity and until that period arrived the municipality was but a small factor in the franchise question. Its permission was hardly asked and while it was willing for any improvement, paid for with extraneous capital, the returns to the capitalist up to that time were very uncertain, often meager, and in many cases disastrous.

From the early inception of the government all franchises were special grants by the legislatures of the different States and these grants were practically monopolies. The idea of the people of that time was to encourage development through private capital, and every inducement and sacrifice was made by them to attain the desired end. In many cases the private capital was supplemented by drafts from the public treasury, when failure seemed imminent. Then, as the country grew and satisfactory return was received from previous investments, capital became bolder, made further invasions into the realms of municipal development, built water works and gas works and horse railroads, all with practically the tacit consent of the municipality affected, but with powers granted by the State, which were often sufficient to overrule the local authorities, until suddenly a wave of protest swept through the country, and general laws were passed authorizing, with due and proper procedure, the formation of the different companies for the different purposes, with complete municipal control, with incidental State supervision.

There are certain governing principles affecting the franchise problem which must be considered:

First—The homogeneity of any community as to whether franchises are inherent or intramural, for example: New York City, with a population of 3,500,000, under one municipal control; the New Jersey section, adjacent to New York, with a population of 1,000,000, composed of 138 different municipalities. These cases are cited as extremes, but they show the variations in conditions.

Second—Character of population—business, manufacturing, farming or residential; concentrating of business; proportion of labor in manufacturing cost; scattering of residences.

Third—Topography and extent of the municipality.

Fourth—The average wealth, taxable and actual.

Large cities generally own their own water supplies—Indianapolis, Denver and Paterson being notable exceptions. The tendency of public opinion is, however, towards municipal ownership, and it can be noted that private plants are being condemned or bought out in every direction. On the one hand new companies are being formed in rising and growing towns, and at the same time other growing towns are putting in their own plants. A water franchise, as a rule, is a permit to fur-

nish water to a community at a given price paid by the consumer, with a bonus paid to the company for fire protection, known as hydrant rental. The great onus in all water plants is to provide for extensions, which largely eat up the profits of private companies, or necessitate increased capital. The tendency of the courts to ignore franchise values in condemnation is having a deterring effect on private capital in water construction, so it is safe to promise that as time goes on the franchise problem in water supply will cease to be of moment.

As to the limit of the franchise for water service, very little discussion seems to have arisen. Where a company installs a plant and supplies the water to the consumer, the franchises are generally perpetual, subject to a periodical renewal of the contracts for hydrant rental, and, of course, subject to condemnation. Where a section is composed of many different municipalities, it some times occurs that a company organized in one town will obtain its water from a company with a franchise in another town, and the periods of their contracts may vary, showing that there is no question of any prospective termination of their franchises.

Of late years the problem of grade crossings has brought the steam railroad company and the municipal apthorities into closer association, in fact into practical partnership, yet any suggestion of management in the number of trains, rates of fare, etc., has been rarely considered a matter of adjudication by the authorities. Another point in which the municipality comes into touch with the railroad company is trackage facilities through and across public streets to connect the factories with the main line. Their construction in all its details is subject to municipal control and their permanency is dependent upon municipal will. These grants cannot be called franchises, but are merely permits, but the companies collect revenue for their use and never pay any part to the city. In certain large cities lately the reconstruction of terminal facilities has been a matter of municipal supervision, and for the permanent privilege of such construction an annual rental is paid into the treasury of the city. In one case, strange to say, the city itself raised the money and built the works, and proposes to collect it from the company in the future.

The construction of gas plants is almost uniformly confined to private corporations. The quality of the gas and the price are regulated but there is no limit to the franchise, as a rule. Contracts for lighting the streets are made for a longer or shorter period, but even the termination or lapse of such contract does not interfere with general consumption. With the recent practice of abandoning small plants and concentrating the manufactures in larger units, the connections of a company may run through many different communities, and the contracts for public lighting vary. One town may be lighted with gas, the one adjacent, with the same service, will use electricity and make no contract for gas.

In discussing franchises of street railroads, where the surface of the public highway is segregated to a certain extent for private use, the principle of usurpation appears an issue. In the original turnpike grants, an old highway was monopolized by the company, or a new one opened by them. The public could use every part of this highway by paying toll and no discrimination existed. Canals and railroads bought their own right of way, but with the laying of iron or steel rails on a public highway an entire new principle was inaugurated and sanctioned by law, viz.: that of private ownership on a public highway. It would seem to the layman's mind somewhat inconsistent for the authorities to grant special rights to a private corporation in a strip of land presumably deeded forever for public use, but street railways, whether propelled by horses, steam, electricity or gasoline, are a fact in our body politic, and are one of the most important factors in our daily life. Originally, like other charters of that time, horse railroads received their grants from the legislature, specifying the route, and were perpetual. Municipal control was incidental and always favorable. The rate of fare was decided by the company, as well as the timing of the trips. The rails were laid as much as possible to keep general traffic away. Prior to the introduction of electricity for traction purposes, special charters generally ceased to be given, and the municipal authorities, under statutory powers, granted charters to horse railroads, and the same privilege has been followed in granting franchises for electric roads.

If in the early fifties a perfectly smooth pavement had been introduced and laid in any given city, and at the same time a complete motor car had been designed and put in use, the question of laying a pair of iron strips on a highway to carry a car would not have been considered. If in the substitution of electricity for horse power twenty years ago, a complete self-propelling car had been invented, the trolley pole and trolley wire would not have come into use. So the present contention on this subject is due to imperfect engineering, and it further emphasizes the fact that with the inevitable

advance in engineering knowledge the premises and arguments of to-day may be in a few years complete nullities, and every franchise, whether perpetual or fifty or twenty-five years' duration map lapse from non use. Considering the traction franchise condition as it is to-day, a small proportion of these franchises are perpetual in name, some with permission for periodical renewals but the general rule is a limited franchise varying from fifteen to fifty years, but in no case has municipal ownership been adopted.

The trend of public sentiment on the growth of street railway travel is very curious. The writer has in mind an old horse car line between a large city and a suburban town of about 8,000 people. There was a steam road between the two places which carried the bulk of the travel. The horse cars ran every twenty minutes, took fortyfive minutes for the trip, most of the time were half filled, and the fare was 10 cents. Without warning the company operating the road reduced the fare to 5 cents, and shortly afterward made application for a trolley franchise, unlimited as to time, with the customary clauses, keeping the fare at 5 cents without transfers. Public sentiment was so keen for the new improvement that the franchise was granted without demur, and the result was that the trolley line ran cars every ten minutes, took twenty-five minutes for the trip and the cars were crowded to the doors, while the steam railroad travel was practically obliterated and everybody was happy. Three years afterwards, with extraordinary expansion elsewhere and a growing insistence on batter terms by other municipalities, this very community could not find words too hard in condemning their own authorities for letting the trolley company get the best of the town.

At this time allusion can be made to the purely municipal development of elevated roads and subways now operated by electricity. They are not very extensive and the franchise problem is not under discussion. The elevated railroads of New York, Brooklyn and Chicago were built under special acts with unlimited franchises and without much municipal control. It is of interest to remember that the Board of Health of the city of New York once attempted to take control, but the attempt was a failure.

The subways of New York and Boston are the two notable instances of municipal ownership, both built by the respective cities and leased to the traction companies under such conditions that the receipts pay for the interest on the bonds and the principal in a series of years.

In the introduction of electric light and power the old-fashioned special charter does not appear, and municipal authority over the private companies is complete. The contracts are made for public lighting for a long or short period, and are then terminable, and there seems to be a variation from the practice in gas and water, in that the franchise ceases at the same time. The doctrine of municipal ownership is being extensively practiced in electric street lighting, and the results are satisfactory, but the application, as a rule, is in smaller cities, where supervision is easy. Where the wires are put under ground generally the company builds and owns the conduits. In some cities the city builds the conduits and the companies furnish and lay the wires. This point is interesting as maintaining the doctrine of public ownership in the highway. Power plants are generally an adjunct to the lighting plant. Independent plants, however, exist.

The conditions of installation of telephones are practically the same as electric lighting—first the poles, and then, as a community grows, subways are used. Telephone franchises are uncertain in their tenure, the telephone system of the country being in limited hands.

The doctrine of municipal ownership is really the problem to consider in future franchise granting, and the first question is, Is the public willing to assume the burden and responsibility of control, and, secondly, is the public able to achieve as economical an administration as can be secured under private enterprise? Municipal administration means political administration, and political administration today is more one of sentiment and sympathy than of business. The enormously increasing functions of municipal administrations are in the line of pure socialism, probably the ideal condition, but a further assumptionshould be made with care. Taking the experience of municipal ownership today it is found that where a minimum of labor is required for administration, such as water supply and electric lighting, very successful results are obtained, but when the control of vast numbers of men is vested in a municipal board, however perfect its membership, the economical end is sometimes lost sight of, and therefore it would not be a apying investment.

One happy solution of municipal ownership is the New York subway, owned by the city and operated by a private corporation. It is financially a success, and gives satisfaction. The proposition of the city of Chicago to purchase the surface lines and lease them is of undoubted merit and further relieves the franchise problem of its present doubtful status, viz.: the

usurpation of public rights in private ownership.

The doctrine of municipal ownership as practiced in Europe is a guide for future development on our continent, but the dissatisfaction that exists there over the high taxation incident to its assumption is probably greater than the complaints that are made on this side of the Atlantic, and furthermore, the power of raising money and the price of it is of potent influence. A very large proportion of cities and towns today are bonded to the limit for absolutely necessary improvements, and to them municipal ownership is a condition not realizable at present.

Mr. John R. Barlow, city engineer of Montreal, Ont., added to the committee's report the following among other sentences:

Every application for a franchise should be contested until the rights of the city are recognized. Companies desiring very extensive use of the streets have gone to the legislature and secured charters from that body which practically give over the streets to them. It is true that there is a provision in their charters that the city shall locate their poles, pipes or conduits, but if the civic authorities refuse to do so, then the company has the power to take their own location. This, as you may perceive, places a city in the position of acquiescence in the franchise, having no real power or control. All water and light should be supplied by the civic authorities and no franchises or charters should be granted to any company desiring the use of the city's streets unless the civic authorities agree thereto.

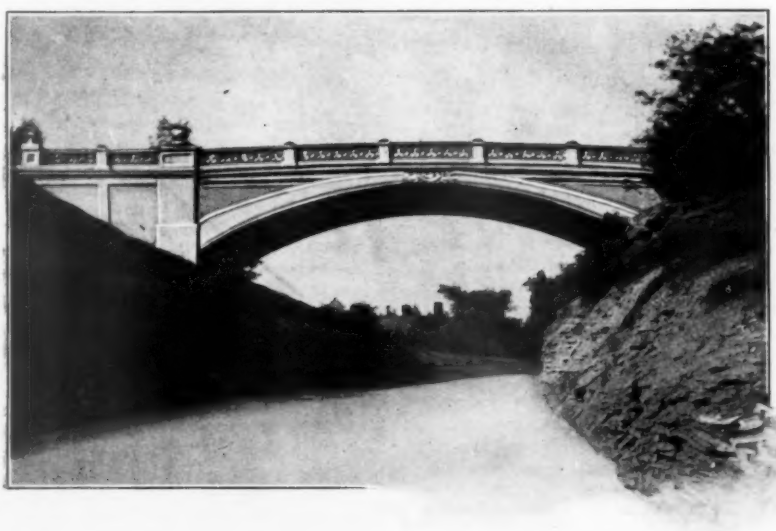
The committee presented the following conclusions for discussion:

Divide the franchise question into two main heads.

1. Those that have control by purchase of their whole equipment.

2. Those that have facilities in public highways.

Of the first little need be said at this time. Of the second we are of opinion that all concessions to use the public highways, whether of water, gas, electric subways or car tracks should be of the nature of permits, revocable at will, or for definite periods, and that no legislation shall be permissible that in any shape usurps the complete ownership of the public in any public property.



A CONCRETE ARCH BRIDGE.

EDITORIAL COMMENT

Building Ordinances Regarding Concrete Blocks.

Insufficient Consideration of Franchises.

Governmental Regulation of Rates of Public Service Corporations.

BUILDING ORDINANCES REGARDING CONCRETE BLOCKS.

In March the city of Chicago adopted in its building ordinance a clause relating to concrete blocks. It is Section 961 and is quoted as follows:

Molded hollow concrete blocks or molded hollow vitrified clay building blocks of the full thickness of a ten-inch wall may be used wherever eight-inch walls are called for by this ordinance and such blocks may also be used wherever twelve-inch brick walls are called for in this ordinance under frame cottages and in one and two-story Class 3 and Class 6 buildings.

It is impossible to say what this section intends. One may say that a ten-inch hollow concrete block may be used in place of an eight-inch brick wall. Another may try to stretch the language to mean that there must be ten inches thickness of concrete and the block must be of such a size as to furnish this thickness of concrete. Again, one may say that the ten-inch block may be used in place of a twelve-inch brick wall under frame cottages and in one and two-story Class 3 and Class 6 buildings, while another may say that permission is given to use the blocks in these classes of walls and not elsewhere, there being no specification regarding the method of building the wall. Still a third may try to extend the claim for solid concrete to say that there must be twelve inches thickness of concrete, whatever the size of the block may be.

The building inspector must be the interpreter of the section when it is so indefinite, and he evidently has plenty of leeway. On the one hand the walls of ten and twelve-inch blocks are amply strong to use in place of eight and twelve-inch brick walls if the blocks are well made of good materials. On the other hand, it is conceivable that concrete walls ten and twelve inches thick would fail if the blocks were badly made of cheap materials, with little cement and careless mixing.

Such a provision as that quoted, if it has been correctly quoted to us, is not a credit to the ability of the Chicago building department to write a specification, and is particularly objectionable because it may be copied by the building departments of smaller cities, which look to Chicago for correct practice in this department.

To say that a ten-inch hollow concrete wall may be used in place of an eight-inch brick is not sufficient. One block may be made with very thin walls which would not carry the required weight, while another might have enough concrete in its cross section to warrant reduction in thickness of block to eight inches.

There is as much difference in the quality of cement blocks as in the quality of bricks and they should be subject to similar specifications regarding crushing strength, absorption, etc., and the approved method of laying should also be stated.

A building inspector favorable to concrete blocks could greatly facilitate their use under the ordinance provision quoted, while a hostile inspector could make it practically impossible to use them. The former might permit much bad work and the latter could prohibit construction better than any now possible with brick, neither one going beyond what he could demonstrate to be a reasonable interpretation of the law.

This example is given to show the necessity of hard work on the part of the committees of the National Association of Cement Users and the cement block machine makers. Little can be done toward the formulation of exact specifications until the experiments now in progress in St. Louis have progressed far enough to warrant publication of results, but much in the line of preliminary work can be done with building inspectors to prevent such ill considered and contradictory regulations as that quoted for Chicago.

These comittees desire copies of the sections of building ordinances referring to the qualities and methods of using concrete and cement blocks. Any such ordinances sent to the editor of MUNICIPAL ENGINEERING will be placed in their hands. Elsewhere in this number will be found the brief regulations adopted in Newark and the full specification adopted in Philadelphia after a full series of tests.

INSUFFICIENT CONSIDERATION OF FRANCHISES.

The Chicago system of tunnels is one of the most recent and most important examples of action upon a valuable franchise without sufficient consideration by experts and the public and various difficulties and various errors of omission and commission come to light from time to time.

Possibly the first of the series of franchises belonging to the history of this enterprise had sufficient attention and was as well written as any of the telephone franchises of the city, for it simply permitted the Illinois Telephone and Telegraph Co. to operate in the city and required that all wires in a central district should be put underground. This franchise ordinance was under discussion for six months before its first passage, when it was vetoed by the mayor and again passed after amendment a month later. It limited the service to be rendered to the transmission of sounds, signals and intelligence by electricity or otherwise.

There was a change of ownership within three months and the plans of the new company for construction apparently contemplated a material increase in the uses to be made of the tunnels.

Their size was fixed as six feet wide and seven feet six inches high on the ground that this size was necessary to string the wires.

It became evident later that this difficulty had been overcome and that the tunnels could be used for transportation purposes.

In September, 1900, about two years after the first franchise was applied for, the company filed amended articles of incorporation under which it would be given powers, in addition to those granted by the franchise and the original articles of incorporation, to distribute mail, newspapers and general merchandise, and also power, heat and light, and expressly refusing the powers granted to railways.

In April, 1902, some eighteen months later, the city seems to have discovered the intentions back of this change in the powers of the company and to have stopped the work on the tunnels on the ground that these new powers were not included in the franchise granted by the city and that a new agreement much be made before they could be exercised within the city limits of Chicago. The company had gone so far as to construct some short sections of tunnel about double the width and height of those authorized by the ordinance, securing permits for them from the city engineer on the ground that the impossibility of putting in frequent manholes demanded main lines of tunnel large enough to admit the large cable reels and other apparatus necessary for stringing wires.

A new franchise was worked out after considerable discussion, which seems to safeguard the interests of the city so far as the acquirement of the plant is concerned, regulation of construction and operation and to a certain extent of rates. It provides for payment to the city of five per cent of the gross receipts for the first ten years, eight per cent for the second ten years and twelve per cent for the remainder of the franchise term to 1929, and for twenty per cent of all receipts from rental of space.

There are two respects in which the franchise failed to receive due consideration. One of these is that of regulation of the amount of capitalization. This is a matter of more importance than the actual regulation of rates in detail. But the city is not alone in its neglect of this subject. Very few cities anywhere pay any attention to it, although, as stated in the article in "Franchises for Gas," elsewhere in this number of MUNICIPAL ENGINEERING, it has been very satisfactorily settled in some English cities.

The second matter which was not sufficiently considered was the sufficiency of the plan as an engineering proposition and its applicability to the present and probable future conditions. The settlement of buildings and streets during the summer was evidence of the lack of consideration of the propriety of methods of construction adopted. The suggested interference of some of the tunnels with passenger subways built according to feasible plans which have been proposed is an evidence that the greater problems of the system have not been fully considered. The subway question in London has been under discussion under the guidance of a special commission for three years and a first report has been issued recently, the first step toward the installation.

The plans for subways in Boston and New York were worked out more rapidly but they also were considered and reconsidered by commissions and committees until all probable influences which might affect them were brought to light. Even then there are some details w...ch now show the effects of lack of study

The Chicago "telephone" tunnel franchise on the other hand, seems, so far as the class of question under consideration is concerned, to have been constructed with the main idea of permitting the company to proceed with its very laudable purpose, upon which it had entered in what seems to be an underhand way, and

there was a strong disposition to delay its operations for as short a time as possible. The result is the incomplete and ill fitting system of tunnels which now exists.

The rights of control which the city has reserved will reduce the effect of the errors that have been made, but the city's officials must watch the steps of its public service corporations much more closely than they have in the past if it is to be saved from such insidious attacks. Sympathy for the condition of a company which has been caught in such an operation is not sufficient reason for remitting in the least the requirements which such great projects make in the way of close and careful study and full, free, open and continued discussion, that as many as possible of the contingencies which may arise in the future may be brought to light.

We sometimes complain of the snail's pace at which public improvements advance, forgetting that the continuation of the discussion adds continuously to our knowledge regarding them and sometimes results in a thorough revision, which could not have been secured had there been more rapid progress.

GOVERNMENTAL REGULATION OF RATES OF PUBLIC SERVICE CORPORATIONS.

There is at this time much discussion of the right and of the propriety of the assumption by government of the right to regulate the rates for public services if such right exists. It is specially directed just now to the question of railroad rates as a result of a paragraph of President Roosevelt recommending that the Interstate Railroad Commission be given the power to regulate railroad rates concerning which complaint of inequity is made.

The same problem arises for discussion with reference to municipal public services, such as water, gas, hot water, electricity, etc., but the discussion thus far has been rather upon the rate that should be fixed rather than upon the right to fix or the propriety of fixing rates. Not that the right to fix rates is asserted, for, almost universally, the fixing of the rates is a matter of contract and no rate is considered fixed until it has been accepted by the company. Perhaps the only exception to this is found in Massachusetts, where gas and electric light rates are modified by a State Board on evidence furnished by both parties to a controversy over them.

A paper by Arthur L. Adams before the Pacific Coast Engineering Society discusses the "Principles Governing the Valuation for Rate-fixing Purposes of Waterworks under Private Ownership," which brings up a number of the problems which arise and exposes the present conditions in such manner as to show their artificiality and the inequitable nature of many of the methods of procedure.

The fitness of the plant, its cost, and the degree of prudence and engineering skill exercised in the acquisition of waterworks property are items which he considers at length and which are seldom, if ever, put upon a proper basis. The results, so far as these items are concerned, depend upon the engineering and business skill exercised in the establishment of the works. These are variables of similar nature whether the plant is owned and operated by the city or by a company. Possibly better business skill will be in evidence in a company but it is quite probable that better engineering will be found in a municipal plant. In case the city owns the plant the public must pay for errors in the engineering and in the conduct of the business. In case a company owns the plant it is common, as Mr. Adams' paper indicates, to make the company pay for such errors.

Under public ownership the people receive the benefit of efficient service in both departments. Under private ownership the company receives the benefit and the values of franchise, of established business and of service become questions of interest in the consideration of rates. It is doubtless true that the great majority of plants under private ownership, especially in growing towns and cities, are reasonably well designed, constructed and managed, so that the profits under the early franchises and contracts are great and the stock much be watered to conceal them from the public. Mr. Adams' process of determining the valuation and rates seems to be based largely on these facts with opportunity for modification of results in case it can be shown that conditions are such that proper profits have not been made.

The most serious objection to his process is due to the lack of knowledge of the actual facts regarding the transactions of the company which it presupposes. The city is obliged to proceed in almost complete ignorance of these facts and must therefore try to obtain the utmost concessions and must, in most cases, finally agree upon rates which may or may not be applicable to the particular plant in question, and, on account of the superior knowledge of the situation by the company are most likely to be favorable to the company rather than to the city or the consumers.

The public service corporation operates a monopoly, the right to which it derives, first from the state by its articles of incorporation or special charter, and second from its contract with the city. The government, preferably through the city branch on account of tis direct interest in the question, has the right to regulate the operation of the monopolies which it grants. Were the officers of the government infallible this regulation could be without recourse. But the officers of the government are liable to error equally with the officers of the companies. In fact, they are, under our present methods of choosing them, more liable to error. The equities of the case are therefore not always easy to determine and must be subject to adjustment. The government is entitled to all the information there is in existence, that it may be upon equal terms with the company, which is in possession of all the information upon both sides of the question. This information can best be obtained by a requirement that all the accounts of a public service corporation shall be kept in as public a manner as they must be kept when operated by the municipality.

When there is such publicity of accounts, it will be comparatively easy to determine all the questions raised in Mr. Adams' paper and the relations of cost of works, degree of prudence and engineering skill and fitness of the plant to the rates charged and the reasons for any errors which may have been made can be determined with comparative ease. The effect which the errors, if any are found, should have upon the returns upon the capital invested can also be adjusted with the minimum of friction.

That the franchise belongs to the public is unquestioned, and that the public should have the benefit of any appreciation in its value is equally unquestionable. That the company, if held responsible for bad management and bad engineering, should also have the benefit of the results of good management is equally true. But if the company is made safe from loss by receiving the same treatment regarding erors in administration which the plant would have under municipal management, the profits of good management should go in large part to the city, only so much going to the company as would encourage it to do its best.

Such a proposition as this makes investment in a public service corporation as safe as investment in city bonds, and gives the city and its citizens most of the benefits of municipal ownership under the form of private ownership. It is quite probable that the return on capital invested which would be required under private ownership would increase the cost of service but little, if any, over the present cost under municipal ownership. If the claims of greater economy of private management are well founded, this interest on capital may be paid wholly or in large part from the saving thus made.

The same principle may, under proper constitutional provisions, be extended to the railroad question, and the regulation operations, more or less automatically, under the conditions of publicity, be the outcome rather than direct and arbitrary regulation of rates.

THE QUESTION DEPARTMENT

BREAKING STRENGTH FORMULAE FOR CONCRETE BEAMS.

Please publish all the formulae you can obtain for the breaking strength of concrete beams, both plain and reinforced.

J. W. B., Roland Park, Md.

The publication of these formulae will not be of the greatest value without full statements of their derivation and of the range of the experiments on which they are based. Since these cannot be given here, the formulae are given with references to articles and books in which these explanations can be found. None of the formulae should be used without full knowledge of their respective limitations.

The following is the notation to which all the formulae have been reduced:

M is the moment of resistance of the beam.

b is the horizontal breadth of the beam.

d is the depth of the beam from the top to the center of gravity of the steel reinforcement.

x is the ratio of the depth of the neutral axis to the depth of the steel measured from the compressive surface.

p is the ratio of cross section of steel reinforcement to cross section of beam above the center of gravity of the steel.

P is the percentage of steel reinforcement or is 100 p.

f is the unit tensile stress in the steel.

c is the compressive stress in the outer fiber of the concrete.

Ec is the modulus of elasticity of concrete in compression.

Es is the modulus of elasticity of steel.

(1) $$M = bd^2 (275\,P + 55)$$

is the formula given in T. L. Condron's paper on "The Strength of Reinforced Concrete" in MUNICIPAL ENGINEERING, vol. xxix. p. 167, and in the Transactions of the Western Society of Engineers, as conforming to the tests made by W. K. Hatt at Purdue University.

(2) $$M = bd^2 (450\,P + 55)$$

is the formula developed by Mr. Condron in the same articles to apply to beams reinforced with Johnson corrugated bars.

(3) $$M = fbd^2 (0.906 - 0.065\,P)$$

is the formula developed by Talbot to fit his tests, which is given in one form in the articles above referred to and in slightly different form in the Proceedings of the American Society for Testing Materials for 1904.

(4) $$M = fpbd^2 \left(1 - \frac{3x}{8}\right)$$

is the formula given by Thompson in his discussion of the papers on tests of concrete beams in the Proceedings of the American Society for Testing Materials for 1904, using the parabolic theory of the variation of stress in the cross section of the concrete beam.

(5) $$M = fpbd^2 \left(1 - \frac{x}{3}\right)$$

is his formula using the straight line theory of this variation. These formulae are developed in Taylor and Thompson's book on "Reinforced Concrete."

(6) $$M = \frac{fbd^2}{120} (P + 0.1)$$

or for usual working conditions with average rock concrete,

(7) $$M = 137.5\,bd^2$$

are empirical formulae for determining the moment of resistance of reinforced concrete beams, proposed by Mr. Condron in MUNICIPAL ENGINEERING, vol. xxix, p. 178.

(8) $$M = bd^2 \left[\frac{5}{12} cx^2 + Pf (1 - x)\right]$$

is the formula used in the design of girders for the Harvard stadium, assuming d to be the same as in the other formulae.

It is given with a table for ease in application in a paper by F. H. Constant on "Aims and Scope of Laboratory Tests of Reinforced Concrete" in MUNICIPAL ENGINEERING, vol. xxviii, p. 248.

(9) $$M = \frac{1}{12} cbd^2 (8x - 3x^2)$$

is the formula for rectangular beams with single reinforcement near tension side, given on page 300 of Marsh's "Reinforced Concrete." He gives other formulae for different methods of reinforcement and for different forms of cross section. He also gives the various formulae and methods of computation used by French engineers with comparisons of the results. Those wishing these refinements of calculation are referred to Marsh's book. The French methods of computation are also given in Morel's "Le Ciment Arme et ses Applications."

(10) $$M = \frac{fd}{3b} \left[\frac{d^3x^3Ec}{Es} + 3p (1 - \tfrac{1}{3}x)\right]$$

is Thacher's formula taken from Buel and Hill's "Reinforced Concrete" page 27, equation 28.

(11) $$M = bd^2 \left[\frac{5}{12} cx^2 + \frac{pf}{d} (1 - x)\right]$$

is Hatt's formula taken from page 43, equation 65 of the same book.

(12) $$M = bd \left(\frac{1}{3} + \frac{1}{2}\,\frac{f}{c}\,\frac{Ec}{Es}\right)$$

is the formula on page 392 of Sabin's "Cement and Concrete," assuming constant modulus of elasticity. If the modulus varies the formula on page 394 is applied, which is

(13) $$M = cbd^2x^2 \left(\frac{5}{12} + \frac{2}{3}\,\frac{f}{c}\,\frac{Ec}{Es}\right)$$

These are all directly applicable to plain retangular beams reinforced with steel near the tension side. The books referred to give modifications for other forms of beam and other methods of reinforcement. They have all been reduced to the same notation for convenience in comparison. A comparison of results for some given cases would be of interest and

is suggested as a recreation for our readers who are interested in the subject.

The ordinary formula for moment of resistance of a rectangular beam will answer for a plain concrete beam using the value of the safe stress in tension of concrete for the factor f in that formula.

There are doubtless other formulae and they will be collected and printed in later numbers of MUNICIPAL ENGINEEGING.

REINFORCED SIDEWALK BLOCKS.

Are there any factories in the country making reinforced sidewalk blocks?

W. H., ———, N. Y.

Diligent search has not yet brought to light any established factory of this sort. Nearly all sidewalk work is laid on the spot, whether plain or reinforced, and whether supported on the soil or on walls or beams over area ways. Can our readers refer us to any such factories as are referred to?

PATENTS ON REINFORCED CURBING.

In addition to the Wainwright steel protected concrete curb named in MUNICIPAL ENGINEERING, vol. xxix, p. 293, reference is made to patent No. 789,588, issued May 9, 1905, to Geo. A. Case, for a combination curbing and street sprinkling apparatus, and it is said that another patent for a perforated metal bond sprinkler combined with a concrete curb and serving also as a protection therefor has been allowed to still another inventor who is not yet ready to announce it.

HOW TO BUILD A CIRCULAR WATER TANK.

The following description of a method of building a circular watering tank is furnished by S. L. Dunlap, of Indianapolis. The steel form to which he refers is one which he has invented and manufactures:

The first thing to consider when building a water tank with concrete is the proper foundation and protection from frost to keep it from settling and cracking. This can be accomplished, after excavation to the frost line, by filling up to within four or six inches of the bottom of the tank with coarse gravel, or, if desired, farm tile may be used.

Concrete to the depth of four to six inches is laid on this gravel or tiling. The steel form, which consists of an inner and outer casing, is then set upon this concrete base. The form is adjustable to any diameter or thickness of wall. The space between these casings is filled with concrete made of about five to one, of the consistency of mason's mortar, slightly tamped or cut from casings to as to form a smooth surface when steel form is removed. Concrete may be reinforced with wire rods or bars. The thickness of the wall should determine the amount of reinforcement. A wall four inches or less in thickness should be reinforced, but thicker than this I consider no reinforcement necessary.

In the course of twenty-four to thirty-six hours the concrete is sufficiently hardened to safely remove casings. All defects are then pointed up, and a cement slush thick enough to carry on a brush from receptacle to tank is then applied to inner walls and bottom, forming a glazed and finished surface.

BOOKS ON ART STONE.

Please send me Hagloch's "Art Stone" and also the back numbers of your magazine containing articles by Paul Wilkes on artificial stone. Should you have any more books treating on the making of artificial stone both chemical and pressure processes, please let me know their titles.

J. M. B., Mexico, Mex.

Hagloch's "Art Stone" cannot be supplied hereafter from this office owing to complaints of his failure to deliver books ordered. In addition to the articles referred to Paul Wilkes has a small pamphlet on "How to Manufacture Hollow Concrete Building Blocks," (50 cents). S. B. Newberry read a valuable paper on this subject before the Association of American Portland Cement Manufacturers. A copy can doubtless be obtained from him at Sandusky, O.

Considerable instruction on the subject will be found in the "Handbook for Cement Users," ($3).

BOOK ON ARTIFICIAL STONE MAKING—LETTERS FOR CEMENT WORK.

Can you furnish me a book of processes for making tomb stones out of Portland cement? I would like the address of some one that can furnish me with reversed letters for artificial stone work.

C. W. C., St. Paul, Minn.

The "Handbook for Cement Users," ($3), is probably the best book in English. There is a little German book, Lucht's "Anleitung fuer die Verarbeitung und Verwendung von Portland Cement," which has many practical suggestions.

W. H. Anderson & Son, Detroit, Mich.; Kramer Bros. Foundry Co., Dayton, O.; Contractors Tool Co., Philadelphia, Pa.; F. H. Crafts, Rochester, N. Y.; Dietz, Franklin & Co., Akron, O.; H. W. Knight & Son, Seneca Falls, N. Y., can supply the lettering stamps desired.

GROUTING A WALL LAID UNDER WATER.

I have at my summer cottage on a northern lake a footpath made along the margin of a shallow bay. The bottom of the bay is of large gravel, and the bank is granite rock. The depth of the water is from two to three feet. In the water along the bank I have laid boulders of about 200 lbs, filling the interstices with gravel, and on the top other courses of boulders, filled in with gravel, until the surfaco has been brought well above the water, when I have topped off with a course of flat stones, with the joints filled in with small gravel. The width of the walk at the top is about four feet, spreading out to six at the bottom. It is such a great success that I want to make it permanent—I know that it will in time be scattered by the frost and tne waves, if left as it now stands. How shall I go about cementing it? What kind of cement shall I use and what proportion of sand? At what consistency must the cement be applied, and how, and wHl it all run out at the bottom? I should add that the place is quite remote from civilization and no skilled help is available.

A. P., Toronto, Ont.

It is difficult to see how this wall can be cemented, or rather grouted, without building a water tight form on the outside of the wall so that when the grout of cement mortar is poured in it will stay where it is put. Some good work has been done in this way, but its success cannot be guaranteed unless it is done by an expert.

Can some one who has had a similar experience make any suggestions?

COLORING FOR CEMENT BLOCKS.

I am anxious to know where I can purchase coloring matter for cement blocks and plaster.

Subscriber, Batavia, O.

The "Handbook for Cement Users" ($3) gives a list of colors for cement work, most of which are mineral colors and can be purchased from the makers of such colors. The most common colors are obtainable of makers of iron oxide paints. See the article on "Coloring of Concrete" by J. P. Sherer, in MUNICIPAL ENGINEERING, vol. xxviii, p. 122.

LIGHT COLORED CONCRETE BLOCKS.

I have just bought and installed a cement block machine. My first work with it will be a nice residence for myself and we are desirous of making as light colored blocks as possible and would like to know what brand of Portland cement you would recommend. As a beginner in this work, what book can you recommend on this subject?

J. W. H., Jefferson City, Mo.

Reference should be made to the letter from the agents for Dexter cement, in MUNICIPAL ENGINEERING, vol. xxix, p. 183, for some information on this subject, also to vol. xxviii, p. 310. The desired result will be approximated at a fairly reasonable cost by using a white sand for the facing of the blocks.

The only book on cement blocks is a small pamphlet by Paul Wilkes on "How to Manufacture Hollow Concrete Blocks" (50 cents). The most information in book form will be found in the "Handbook for Cement Users" ($3) and the bound volumes of MUNICIPAL ENGINEERING for the past three years.

LIST OF CEMENT BRANDS.

Allow me to suggest an alphabetical list of the names of the brands of the different cements alphabetically.

V. H. K., Atlanta, Ga.

An alphabetical list of the cement brands on the American market will be found on page 195 of tne "Directory of American Cement Industries" ($5). It gives name of manufacturer for each, and kind of cement.

THE BEST CONCRETE BLOCK MACHINE.

We would like to ask you which firm in your judgment manufacturers the best cement block machine. We are contemplating the buying of a machine to run by power from our mill and to manufacture the same.

We would like also to know which in your own judgment is the best cement to use for that purpose, the rock or the marl.

K. L. & M., Kaukauna, Wis.

The editor cannot undertake to answer these questions. The inquirer should read the numerous articles on the subject which have appeared in MUNICIPAL ENGINEERING during the last three years and must then have some experience under the conditions in his locality before he can make a decision which will be even approximately satisfactory. The demands of the trade, the kind of work he is willing to do, the competition with other materials, the attitude of architects, the expertness of the workmen and experience of superintendent as well as personal preferences must all be known before a machine can be confidently selected for a given place. While the number of new patents on machines and blocks averages one a week it is manifestly impossible to make a decision which is permanent.

The question of selection of cement is rather a question of individual cement than of material or methods of manufacture, and is also largely a matter of individual preference among a large number of excellent brands of both rock and marl cements.

HOW TO MAKE CONCRETE BLOCK WALLS WATER-PROOF.

If there is any way of preventing cement building blocks from leaking through the walls after they are laid up in the wall or any mixture or paint you can use will you please inform me. I have two block machines and the blocks will absorb some moisture more than they should.

J. A., Blue Rapids, Kan.

The most important step to take is to use cement enough to fill the voids in the sand and gravel or stone used in making the blocks. But even then it is extremely difficult to make blocks water-proof by the dry process. There are a number of preparations on the market which, it it claimed, will produce the desired result, some being mixed with the materials in making the blocks and some applied after they are made. They will be found listed in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings "Antihydrine," "Damp-proof Coatings," "Dehydratine," "Formulae," "Water-proofing Formulae."

HOW TO BUILD CEMENT CISTERNS.

Can you give me any information as to the best method to build a cement cistern or how the forms are built?

E. L. H., Youngstown, O.

The forms supplied by S. L. Dunlap, 3019 Park Avenue, Indianapolis, Ind., Jackson Cement Sewer Pipe Co., Jackson, Mich., are convenient and will be accompanied by full instructions for use. See the description of process of making concrete watering trough elsewhere in this department for description of part of the work of building a cistern.

MAKERS OF SILL MOLDS.

We are in the market for a good practical sill mold. Will you kindly inform us of a good make?

C. P. C., Walworth, Wis.

Most of the concrete block machine makers listed in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the heading "Concrete Construction Machinery" make sill molds. Reference to their advertisements will show who makes specialties of the sill machines.

EFFECT OF OIL ON CONCRETE.

I want to use cement floors in a linseed oil mill if it is practicable. Can you give me any information as to the action of oil on concrete?

J. J. T., Amsterdam, N. Y.

There is but little information upon the subject of the effect of oil upon concrete. Mr. James C. Hain, engineer of masonry construction on the Chicago, Milwaukee & St. Paul railway, made some experiments during 1903 and 1904, which have recently been reported upon. The results of these experiments may be briefly stated as follows, the oils named being those with which the experiments were made: Mineral oil, petroleum, does not disintegrate the concrete, but soaks into it and affects the strength somewhat. A drying oil, boiled linseed, did not disintegrate nor soak into the briquettes, the latter probably because it dried on the surface and prevented the entrance of additional oil. A semi-drying oil, castor, and an animal oil, whale, affected a small percentage of the briquettes by disintegration. Animal fat, lard oil, disintegrated most of the briquettes, but did not affect some of them. Signal oil, a mixture of animal fat and mineral oil, acted in much the same way as lard oil alone.

In a letter to *Engienering News* regarding these tests Maximilian Toch gives some suggestions of chemical reasons for the reported actions, in the action of acids in the animal oil upon the lime in the cement. He says that he knows that raw linseed oil will injure a concrete which is rich in lime. Paraffine oils, mineral oils, have no effect upon concrete so far as he has observed.

CROSS SECTION OF SIDE HILL STREET.

Would you kindly give me the proper crown for a street 30 feet wide, the curb line of one side being 0.40 higher than the other. Also state whether or not the break in the crown should be directly in the center or to one side of the street.

C. M. B., Crestline, O.

Reference should be made to the article by Robert P. Woods, on "Street Grades and Cross Sections in Asphalt and Cement" in MUNICIPAL ENGINEERING, vol. xvii, p. 190, for practical working out of such cases. Rosewater's table of crowns for paved streets will be found in vol. xiv, p. 248. If his rules are followed, if the street is level and if the pavement is brick, the crown may be located 5 feet from the higher gutter, thus making the lower side half of a 50-foot street and the crown 0.63 foot above the lower gutter and 0.23 foot above the upper gutter, which very nearly conforms with the elevation 5 feet out from the higher gutter if determined from the cross section of a 30-foot street.

Should the street not be level the crown would be reduced and should the street be asphalt it would be increased.

There are many articles on this sub-

ject in MUNICIPAL ENGINEERING, the latest being in vol. xxv, p. 28, with references to many of the preceeding articles.

MACHINE FOR PRINTING TITLES ON MAPS.

Could you put me in communication with manufacturers of device for printing titles on maps, etc.? I have seen such an instrument, somewhat of an enlarged hand stamp, but using metal type and printers' ink, but do not know by whom made.

W. J. P., Bessemer, Ala.

It is probable that any maker of stencils and stamping outfits can supply what is wanted. The best satisfaction is reported from the use of type with metal body and rubber face. Some teachers of drawing recommend this method of setting out titles and other lettering, the stamping being done with light red ink and filled in with pen and India ink.

Eimer and Amend of St. Louis have an outfit for printing topography on maps and may be able to supply the letter printing outfit desired. Can our readers refer our correspondent to any outfit on the market specially for direct map lettering?

INFORMATION ABOUT TAR MACADAM PAVEMENTS.

Will you kindly let me know if you have ever published in your magazine a description in detail of tar macadam as a pavement? We are now building a considerable amount of new streets and are desirous of getting the best results from the macadam. The stone obtainable about here is principally granite and while we have been using a black rock, known locally as nigger-head rock, for the top course, we find that it grinds rapidly and does not possess the proper cementing qualities.

Tar has been suggested by some as the proper thing to mix with the top course to act as a binder, and I would like to get something descriptive of the process in detail, including specifications.

J. W. N., ———, N. C.

Among the many articles which have appeared in MUNICIPAL ENGINEERING regarding tar macadam and bitulithic, which is an improved form of bituminous macadam pavement, the following give descriptions and specifications in full: Concerning tar macadam, in vol. xix, pp. 283 and 362 and in vol. xx. p. 296, the latter article by the city engineer of Hamilton, Ont., who has used this kind of paving. Criticisms of the Hamilton pavement will be found in vol. xix, p. 423 and vol. xx, pp. 323 and 370. Descriptions of the methods of laying bitulithic pavement will be found in vol. xxv, pp. 99 and 325 and vol. xxvi, p. .117 and specifications in vol. xxi, p. 40, and vol. xxii, p. 185. There are many other articles on the two kinds of pavement in all the volumes from vol. xix down to date.

MANUFACTURERS OF RATTLERS FOR TESTING PAVING BRICK.

I would like to have the address of one or more manufacturers of rattling machines to test vitrified brick.

R. S. City Engineer, ——, La.

The ordinary foundry rattler, used in iron foundries for cleaning castings is generally used for this purpose. The dimensions fixed as standard by the National Brick Manufacturers' Association are 28 inches in diameter and 20 inches in length, measured inside the rattling chamber, but other sizes are permitted, varying in length from 18 to 24 inches and in diameter from 26 to 30 inches. There much be no shaft through the chamber and the cross section must be a regular 14-sided polygon, with gray cast iron heads and steel plate staves, 1-4-inch apart. The number of staves may vary from 12 to 16 and the space between them from 1-8 to 3-8 inch.

Manufacturers of foundry plant equipments can supply what is wanted. The nearest to Louisiana known to the writer are Heyl and Patterson, 51 Water St., Pittsburg, Pa.; S. Obermayer Co., 647 Evans St., Cincinnati, O.

CAPACITY OF ELECTRIC WIRES AS CONDUCTORS.

Please advise where we can secure a technical work on electricity which will cover among other things information as to size of wire for different voltages of electricity and the distances the various wires will carry these voltages.

B. E. S., Bellingham, Wash.

Foster's "Electrical Engineers' Pocket Book," ($5), probably contains all the information desired.

COST OF GARBAGE COLLECTION AND DISPOSAL.

Where can I get information about the cost of garbage collection and disposal?

J. G. B., St. Louis, Mo.

There is but little in print upon this subject. Some information is given in Chapin's "Municipal Sanitation in the United States" and in Goodrich's "Disposal of Town's Refuse." The article on "The Incineration of Municipal Waste," by H. G. Bayles on page 255 of the October number also contains some information. Aside from these references there are only scattered figures such as those found in MUNICIPAL ENGINEERING, vol. x, p. 201; vol. xv, p. 31; vol. xxi, p. 152; vol. xxii, p. 395, etc.

EFFECT OF PILE DRIVING UPON SURROUNDING TERRITORY.

I am desirous of some information as to the effect of pile driving upon a lot of an adjoining owner.

T. C. J., ———, Va.

This is a problem which must be studied on the ground. Reference may be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING under the headings "Civil Engineers" and "Consulting Engineers" for names of persons competent to give a judgment on the case.

INFORMATION ABOUT INDIANAPOLIS FRANCHISES.

I wish to secure data which wil show the provisions of the present franchises in Indianapolis, particularly gas; the practical results of their operation; and their success or failure. Can you tell me where these facts may be secured?

I am particularly interested in a recent franchise that has been granted to the Citizens' Gas Company and beg to ask whether you know of any instance where this plan has been tried, now it promises to work and any criticism that has been made on it?

M. R. M., New York City.

The provisions of gas franchises in Indianapolis are discussed in an article on "Gas Franchises" elsewhere in this number of MUNICIPAL ENGINEERING. Since the new charter of the city was put in operation in 1891 franchises have taken the form of contracts prepared by the Board of Public Works and approved by the city council. As a consequence they have usually received more consideration and with more expert assistance than the ordinary franchise ordinance receives from a city council. The franchises of the Consumers' Gas Trust Company and of the Citizens' Gas Company are the only ones which have been made on lines which may be termed new, but all the franchises contain provisions which are abreast of the latest advances. That of the Citizens' Gas Company is the first to require publication of accounts and to make what promises to be a really effective provision for supervision of accounts and methods of operation. The two companies are intended to be public service corporations in the fullest sense and the fullest benefit of the Consumers' Gas Trust Company is not enjoyed only because for personal gain advantage has been taken of technicalities by some of these financially interested to depart entirely from the expressed and implied purpose of the company and on account of the failure of natural gas to wind up the company and distribute the proceeds of the sale of its property among its stockholders instead of continuing it in the business of furnishing gas at cost. The Citizens' Gas Company has been formed to take its place and to continue its work if possible.

CONCRETE

Steel Concrete Pipes—Tests on Structural Material—Building Regulations for Concrete Blocks.

Experiments on Steel-Concrete Pipes.

Preliminary surveys of many irrigation projects in the arid States have shown that pressure pipes or, as they are often called, "inverted siphons," will be necessary for the economical construction of some of the works contemplated by the Reclamation Service. Hitherto such pipes have been made of iron or steel or of wood staves bound with iron or steel rods. During the last few years the manufacture of steel has been so improved that it has entirely replaced iron in all important structures. The choice of material for pressure pipes has therefore been limited to the two materials, steel and wood. Recently steel-concrete has been esteemed much more durable material than either steel or wood. As it is important that the structures built by the government in all its reclamation projects should be of a permanent nature, it is desirable that the best possible material should be used. To this end Mr. John H. Quinton of the United States Geological Survey, has conducted experiments on steel-concrete pipes to determine their durability and permanence, especially when used in connection with water supplies. The results of his investigations

are embodied in a recent water-supply and irrigation paper (No. 143), entitled "Experiments on Steel Concrete Pipes on a Working Scale." Heretofore similar investigation have been made on a small scale, and the conclusions which have been drawn from them are shown by Mr. Quinton to be erroneous in many respects.

Although steel-concrete is undoubtedly much more durable than either steel or wood, it is far from perfect as material for water pipes. Concrete is porous, and while theoretically it might be composed of such material as would render it impervious to water under ordinary pressures, practically it is difficult to make it so. To determine just how much pressure of water ordinary well-made concrete would stand without leaking seriously, and what mortar would most effectually stop leaking, and up to what pressure, were the main objects of Mr. Quinton's experiments.

It was recognized that experiments with small pipes would not be of such practical value as those with pipes of sizes more nearly commensurate with the work in hand. It was finally decided to make seven pipes, each five feet in diameter inside and twenty feet long, with a six-inch thickness of concrete shell inclosing an armor of steel rods sufficient to resist a head of 150 feet of water with a factor of safety of four. The quantities of water to be carried in the different projects vary from 250 to 1,500 second-feet, and this size seemed as small as it would be advisable to experiment with in order to show the practical difficulties of construction, as well as flaws and imperfections in the pipe which might arise from careless or defective workmanship.

Water under pressure tells the truth without fear or favor and a careful reading of the report will show that there are many practical difficulties to be overcome in the construction of steel concrete pipe, and that the most careful attention to details and rigid inspection and supervision are necessary to produce a steel-concrete pipe that will stand 100 feet of head of water without appreciable leakage.

The compositions and dimensions of his seven test pipes are minutely described by Mr. Quinton. The pipes were all made by workmen skilled in making concrete. After describing the method of pipe construction that was used and the apparatus employed for testing pipes Mr. Quinton gives in detail the results of the numerous tests made with his seven pipes. The final chapter of conclusions and admonitions will be found most suggestive by all workers in steel-concrete.

The following suggestions of precautions to be taken in making concrete pipes for use under pressure are selected from that chapter:

1. Do not allow the sun's rays to touch the concrete when it is being mixed and placed in the form. If necessary, build a shed over the work.

2. If the steel-concrete pipe cannot be made continuously by machine, do as much of the hand tamping as possible in radial directions. When the tamping must be done at right angles to the radius of the pipe, either in longitundinal or circumferential directions, avoid as far as possible the formation of seams or cleavage planes from delays in placing the forms and adding fresh material. By making the concrete very wet delays will not be so dangerous as in the case of dry concrete.

3. Be careful in tamping not to spring the longitudinal rods, and use as few of these as will suffice to hold the circumferential rods in place, except in case of vertical curves in the pipe, when additional rods or steel cables must be used on the longer side of the curved part of the pipe.

4. Do not depend upon the tensile strength of the concrete, but make the steel rods of such size and distance apart as will insure no greater stretch of the steel than 0.04 inch in any rod from the maximum pressure to which the pipe is to be subjected.

5. Make the inside diameter of the pipe one and a half inch larger than required, to allow space for putting two coats of plaster on the inside.

6. As soon as the pipe is completed give the inside one coat of plaster one-half inch thick, composed of one part cement to one and a half part of sand, and a small quantity of lime paste, thoroughly cooled, to retard setting. Keep pipe well wet ahead of the plastering. When this coat, which may be left rough, is dry, put on another coat about one-fourth inch thick of plaster composed of one part of sand to one part of cement. This coat should be troweled to a smooth surface, and when it is dry the entire inside surface of the pipe should be covered with a thick wash of fine cement and water.

7. Provide for drainage of water which may leak when the pipe is first filled, so that sufficient water may not remain in the trench to soften the ground under the pipe.

8. Bury the pipe under the ground so that there will be in no place less than two feet between the top of the pipe and the natural surface of the ground.

9. In very cold climates provide means for draining the pipe, so that it can be emptied at the end of each irrigating season.

10. The soap and alum mixture may be used to advantage in making the concrete, but reliance for impermeability must be placed on the plastering rather than on the material of the pipe.

11. Do not use steel-concrete pipes for heads over seventy feet, except for short distances, where a hundred-foot head might be used by taking special precautions.

It may be asked why, in view of the fact that a head of seventy feet is likely to crack a five-foot steel-concrete pipe, it is recommended to build pipes of such diameter for use under such a head. It may be answered that a steel-concrete pipe with a crack and a small, gradually decreasing leakage may be, and probably is, much more durable than a pipe made of steel, or of wood with steel bands or

rods, and the leakage, under ordinary circumstances, may not be as much as is now found in many lines of cast-iron pipes in our large cities.

Mr. Quinton's report is published by the Survey as 'Water Supply and Irrigation Paper No. 143." It is intended for free distribution and may be obtained on application to the director of the Geological Survey, Washington, D. C.

The Tests of Structural Materials at St. Louis.

The work of the United States fuel-testing plant, which began operations during the St. Louis Exposition, on its grounds, has been extended to the testing of structural materials, including, up to this time, timber and mortars and concretes and their ingredients.

An advisory board has been selected to aid in the direction of the investigations, and it has representatives chosen from the following societies:

American Society for Testing Materials.
American Society of Civil Engineers.
American Society of Electrical Engineers.
American Society of Mechanical Engineers.
American Institute of Mining Engineers.
American Institute of Architects.
American Railway Engineering and Maintenance of Way Association.
American Railway Master Mechanics' Association.
Association of American Portland Cement Manufacturers.
Geological Society of America.
National Association of Cement Users.
National Board of Fire Underwriters.
National Fire Protection Association.
National Lumber Manufacturers' Association.

There is also associated with this advisory board a representative from each of the following branches of the government:

Bureau of Yards and Docks, U. S. N.
Corps of Engineers, U. S. A.
Forestry Service.
Geological Survey.
Isthmian Canal Commission.
Reclamation Service.
Supervising Architect.

The president of this board is Dr. Charles B. Dudley and the secretary is Mr. Richard L. Humphrey.

The organization of the fuel and timber-testing work was well established last year, and that of the other structural materials has been organized during the summer.

At a meeting of representatives from societies directly interested in tests of concrete and concrete materials the following organizations were represented:

American Society of Civil Engineers.
American Society for Testing Materials.
Joint Committee on Concrete and Reinforced Concrete.
National Association of Cement Users.
National Board of Fire Underwriters.
National Fire Protection Association.
Association of American Portland Cement Manufacturers.
Concrete Block Machine Manufacturers' Association.
United States Geological Survey.

It was decided to form a joint committee for the investigation of the fire-resisting properties of cement mortars and concretes. The committee organized by the election of Mr. Richard L. Humphrey chairman and Mr. Robert W. Lesley secretary pro tem.

A plan for the first proposed investigations was adopted as follows:

The first series of tests will be made on sand mortars, no facing being used in the manufacture of the block, which will be of a standard size, 9x12x24.

Another series will be made, using dry, medium and very wet mixtures, using three grades of mortars for each condition, viz., rich, medium and lean.

A series of blocks will be made under the direction of the committee of the Concrete Block Manufacturers' Association, in accordance with common practice.

In a test oven three blocks of each series will be submitted to the test, two with the face toward the inside of the furnace and one with the back of the block facing the inside of the furnace. The blocks are to be laid in lime mortar, and four three-inch-diameter Bunsen burner jets, with a fire-brick baffle, will be used for heating the furnace. It is proposed to raise, at a uniform rate, the temperature of the test oven to a temperature of 1,800 degrees Fahrenheit during a period of one and one-half hour, and maintain this temperature for one-half hour. It is then proposed to turn two streams of water of twenty pounds pressure, at the nozzle, against the inner walls of the test chamber from points diagonally opposite each other, for a period of five minutes.

At the conclusion of the test, wherever possible, it is the intention to make a determination of the strength and other physical properties.

Suggestions will be welcomed as to the best methods of procedure and tests to make, and it is hoped that the work will receive cordial support.

Building Regulations of Concrete Blocks.

The city of Philadelphia has recently adopted rules and regulations regarding the manufacture and use of hollow concrete blocks which are based on tests made in the Henry S. Spackman laboratory. They should therefore be the most scientifically constructed of any yet prepared, and, while in some details they do not fit all conditions, it is certain that they will insure safe and durable structures. The regulations are as follows:

RULES AND REGULATIONS COVERING THE MANUFACTURE AND USE OF HOLLOW CONCRETE BUILDING BLOCKS IN THE CITY OF PHILADELPHIA.

1. Hollow concrete building blocks may be used for building six stories or less in height, where said use is approved by the Bureau of Building Inspection, provided, however, that such blocks shall be composed of at least one (1) part of standard Portland cement and not to exceed five (5) parts of clean, coarse, sharp sand or gravel, or a mixture of at least one part of Portland cement to five (5) parts of crushed rock or other suitable aggregate. Provided further that this section shall not permit the use of hollow blocks in party walls. Said party walls must be built solid.

2. All material to be of such fineness as to pass a half-inch ring and be free from dirt or foreign matter. The material composing such blocks shall be properly mixed and manipulated, and the hollow space in said blocks shall not exceed the percentage given in the following table for different height walls and in no case shall the walls or webs of the block be less in thickness than one-fourth of the height. The figures given in the table represent the percentage of such hollow space for different height walls.

Stories.	1st.	2d.	3d.	4th.	5th.	6th.
1 and 2	33	33				
3 and 4	25	33	33	33		
5 and 6	20	25	25	33	33	33

3. The thickness for walls for any building where hollow concrete blocks are used shall not be less than is required by law for brick walls.

4. Where the face only is of hollow concrete building block and the backing is of brick, the facing of hollow concrete blocks must be strongly bonded to the brick either with headers projecting four inches into the brick work, every fourth course being a heading course, or with approved ties, no brick backing to be less than eight inches. Where the walls are made entirely of hollow concrete blocks, but where said blocks have not the same width as the wall, every fifth course shall extend through the wall, forming a secure bond. All nails where blocks are used shall be laid up in Portland cement mortar.

5. All hollow concrete building blocks, before being used in the construction of any buildings in the city of Philadelphia, shall have attained the age of at least three (3) weeks.

6. Wherever girders or joists rest upon walls so that there is a concentrated load on the block of over two (2) tons, the blocks supporting the girder or joists must be made solid. Where such concentrated load shall exceed five (5) tons the blocks for two (2) courses below, and for a distance extending at least eighteen (18) inches each side of said girder shall be made solid. Where the load on the wall from the girder exceeds five (5) tons, the blocks for three (3) courses underneath it shall be made solid with similar material as in the blocks. Wherever walls are decreased in thickness the top course of the thicker wall to be made solid.

7. Provided always that no wall or any part thereof composed of hollow concrete blocks shall be loaded to an excess of eight (8) tons per superficial foot of the area of such blocks, including the weight of the wall, and no blocks shall be used that have an average crushing strength less than 1,000 pounds per square inch of area at the age of twenty-eight days, no deduction to be made in figuring the area for the hollow spaces.

8. All piers and buttresses that support loads in excess of five (5) tons shall be built of solid concrete blocks for such distance below as may be required by the Bureau of Building Inspection. Concrete lintels and sills shall be reinforced by iron or steel rods in a manner satisfactory to the Bureau of Building Inspection, and any lintels spanning over four feet six inches in the clear shall rest on solid concrete blocks.

9. Provided that no hollow concrete building blocks shall be used in the construction of any building in the city of Philadelphia, unless the maker of said blocks has submitted his product to the full test required by the Bureau of Building Inspection and placed on file with said Bureau of Building Inspection a certificate from a reliable testing laboratory showing that samples from the lot of blocks to be used have successfully passed the requirements of the Bureau of Building Inspection, and filing a full copy of the test with the bureau.

10. A brand or mark of identification must be impressed in or otherwise permanently attached to each block for purpose of identification.

11. No certificate of approval shall be considered in force for more than four months unless there be filed with the Bureau of Building Inspection, in the city of Philadelphia, at least once every four months following, a certification from some reliable physical testing laboratory showing that the average of three (3) specimens tested for compression and three (3) specimens tested for transverse strength comply with the requirements of the Bureau of Building Inspection of the city of Philadelphia, said samples to be selected either by a building inspector or by the laboratory from blocks actually going into construction work. Samples must not be furnished by the contractors or builders.

12. The manufacturer and user of any such hollow concrete blocks as are mentioned in this regulation, or either of them, shall at any time have made such tests of the cements used in making such blocks or such further tests of the completed blocks, or of each of these, at their own expense, and under the supervision of the Bureau of Building Inspection, as the chief of said bureau shall require.

13. The cement used in making said blocks shall be Portland cement, and must be capable of passing the minimum requirements as set forth in the "Standard Specifications for Cement" by the American Society for Testing Materials.

14. Any and all blocks, samples of which, on being tested under the direction of the Bureau of Building Inspection, fail to stand at twenty-eight days the tests re-

quired by this regulation, shall be marked condemned by the manufacturer or user and shall be destroyed.

15. No concrete blocks shall be used in the construction of any building within the city of Philadelphia until they shall have been inspected and average samples of the lot tested, approved and accepted by the chief of the Bureau of Building Inspection.

Specifications governing method of testing hollow block:

1. These regulations shall apply to all new materials such as are used in building construction, in the same manner and for the same purposes, as stones, brick, concrete, are now authorized by the building laws, when said new material to be substituted departs from the general shape and dimensions of ordinary building brick, and more particularly to that form of building material known as hollow concrete block manufactured from cement and a certain addition of sand, crushed stone or similar material.

2. Before any such material is used in buildings an application for its use and for a test of the same must be filed with the chief of the Bureau of Building Inspection. A description of the material and a brief outline of its manufacture and proportions of the material used must be embodied in the application.

3. The material must be subjected to the following tests: Transverse, compression, absorption, freezing and fire. Additional tests may be called for when, in the judgment of the chief of the Bureau of Building Inspection, the same may be necessary. All such tests must be made in some laboratory of recognized standing, under the supervision of the engineer of the Bureau of Building Inspection. The tests will be made at the expense of the applicant.

4. The results of the tests, whether satisfactory or not, must be placed on file in the Bureau of Building Inspection. They shall be open to inspection upon application to the chief of the bureau, but need not necessarily be published.

5. For the purposes of the tests at least twenty (20) samples or test pieces must be provided. Such samples must represent the ordinary commercial product. They may be selected from stock by the chief of the Bureau of Building Inspection or his representative, or may be made in his presence, at his discretion. The samples must be of the regular size and shape used in construction. In cases where the material is made and used in special shapes and forms too large for testing in the ordinary machines, smaller-sized specimens shall be used as may be directed by the chief of the Bureau of Building Inspection, to determine the physical characteristics specified in Section 3.

6. The samples may be tested as soon as desired by the applicant, but in no case later than sixty days after manufacture.

7. The weight per cubic foot of the material must be determined.

8. Tests shall be made in series of at least five, except that in the fire tests a series of two (four samples) are sufficient. Transverse tests shall be made on full-sized samples. Half samples may be used for the crushing, freezing and fire tests. The remaining samples are kept in reserve, in case unsual flaws or exceptional or abnormal conditions make it necessary to discard certain of the tests. All samples must be marked for identification and comparison.

9. The transverse tests shall be made as follows: The samples shall be placed flatwise on two rounded knife-edge bearings set parallel, seven inches apart. A load is then applied on top, midway between the supports, and transmitted through a similar rounded knife edge until the sample is ruptured. The modulus of rupture shall then be determined by multiplying the total breaking load in pounds by 21 (three times the distance between supports in inches), and then dividing the result thus obtained by twice the product of the width in inches by the square of the depth in inches.

$$R = \frac{3\,W\,l}{2bd^2}.$$

No allowance should be made in figuring the modulus of rupture for the hollow spaces.

10. The compression test shall be made as follows: Samples must be cut from blocks so as to contain a full web section; samples must be carefully measured, then bedded flatwise in plaster of paris to secure a uniform bearing in the testing machine and crushed. The total breaking load is then divided by the area in compression in square inches. No deduction to be made for hollow spaces; the area will be considered as the product of the width by the length.

11. The absorption tests must be made as follows: The sample is first thoroughly dried to a constant weight. The weight must be carefully recorded. It is then placed in a pan or a tray of water, face downward, immersing it to a depth of not more than one-half inch. It is again carefully weighed at the following periods: Thirty minutes, four hours and forty-eight hours, respectively, from the time of immersion, being replaced in the water in each case as soon as the weight is taken. Its compressive strength while still wet is then determined at the end of the forty-eight-hour period in the manner specified in Section 10.

12. The freezing tests are made as follows: The sample is immersed as described in Section 11, for at least four hours, and then weighed. It is then placed in a freezing mixture or a refrigerator, or otherwise subjected to a temperature of less than 15 degrees Fahrenheit for at least twelve hours. It is then removed and placed in water, where it must remain for at least one hour, the temperature of which is at least 150 degrees Fahrenheit. This operation is repeated ten times, after which the sample is again weighed while still wet from the last thawing. Its crushing strength should then be determined as called for in Section 10.

13. The fire test must be made as follows: Two samples are placed in a cold furnace in which the temperature is gradually raised to 1,700 degrees Fahrenheit. The test piece must be subjected to this temperature for at least thirty minutes. One of the samples is then plunged in cold water (about 50 to 60 degrees Fahrenheit) and the results noted. The second sample is permitted to cool gradually in air and the results noted.

14. The following requirements must be met to secure an acceptance of the materials: The modulus of rupture for concrete blocks at twenty-eight days old must average 150 and must not fall below 100 in any case. The ultimate compressive strength at twenty-eight days must average 1,000 pounds per square inch, and must not fall below 700 pounds in any case. The percentage of absorption (be-

ing the weight of water absorbed divided by the weight of the dry sample) must not average higher than 15 per cent. and must not exceed 20 per cent. in any case. The reduction of compressive strength must not be more than 33 1-3 per cent., except that when the lower figure is still above 1,000 pounds per square inch the loss in strength may be neglected. The freezing and thawing process must not cause a loss in weight greater than 10 per cent. nor a loss in strength of more than 33 1-3 per cent., except that when the lower figure is still above 1,000 pounds per square inch the loss in strength may be neglected. The fire test must not cause the material to disintegrate.

15. The approval of any material is given only under the following conditions:

(a) A brand mark for identification must be impressed on or otherwise attached to the material.

(b) A plant for the production of the material must be in full operation when the official tests are made.

(c) The name of the firm or corporation and the responsible officers must be placed on file with the chief of the Bureau of Building Inspection, and changes in the same promptly reported.

(d) The chief of the Bureau of Building Inspection may require full tests to be repeated on samples selected from the open market when, in his opinion, there is any doubt as to whether the product is up to the standard of these regulations and the manufacturer must submit to the Bureau of Building Inspection once in at least every four months a certificate of tests showing that the average resistance of three specimens to cross-breaking and crushing are not below the requirements of these regulations. Such tests must be made by some laboratory of recognized standing on samples selected by a building inspector or the laboratory, from material actually going into construction, and not on ones furnished by the manufacturer.

(e) In case the results of tests made under these conditions should show that the standard of these regulations is not maintained the approval of this bureau to the manufacturer of said blocks will at once be suspended or revoked.

Tests made under the specifications of the city of Philadelphia on concrete blocks in the market here have developed about the following results: Modulus of rupture, 150 to 175 pounds; compressive strength, 1,200 to 1,600 pounds per square inch; absorption, 5 per cent.

The compressive strength is reduced little, if any, by the water absorbed. Freezing tests show little loss. The average compressive strength after freezing is in the vicinity of 1,000 pounds per square inch. The blocks passed the fire tests well.

REGULATION OF CONCRETE BLOCKS IN NEWARK, N. J.

The building regulations regarding concrete construction recently adopted by the city of Newark, N. J., are much shorter and more specific, and therefore do not cover all the conditions which may arise as well as the Philadelphia regulations. Where detailed tests are difficult to secure there may be some excuse for this class of rules, but on the one hand they will work hardships in many cases, and on the other it is not probable that they will permit positively bad construction if they are conscientiously enforced.

Cement Built in Forms.

Cement built in forms shall consist of a standard Portland cement, one part cement, two parts of sharp grit sand, free from loam or dirt, four parts broken stone no greater than one and a half inch in diameter, and no walls or building of this construction shall be higher than twenty (20) feet; above this height must be steel-concrete construction. This construction is for foundation to grade. No ashes will be allowed.

Concrete Blocks or Artificial Stone.

Cement building blocks shall be constructed of a standard Portland cement mixed with sharp grit sand free from loam or dirt, crushed stone, slag or gravel in proportions of one to four—one part cement, one and a half part of sand to two and a half parts of crushed stone, to pass through a three-fourths-inch screen.

Blocks shall not be larger than thirty-six inches long and ten inches in height, and not less than ieght inches nor greater than sixteen inches wide. Blocks may have one or more hollow spaces, provided that no more than one-third of each block is hollow.

Blocks shall be at least thirty days old before being used in any building wall, and stand a tensile test of 150 pounds to the square inch and 1,500 pounds compression test.

WATER SUPPLY

Austin Water Plant—Buffalo Water Supply—Fire Department Water Supply—Diversion of New Jersey Water.

Valuation of Austin, Ill., Water Plant.

The Austin, Ill., water system, purchased by the city of Chicago last July for $250,000, is alleged to be worthless. It it claimed that the parts of the water pipe system of service to the city are worth less than $50,000. Experts estimate that it will cost at least $200,000 to put the system in proper shape. It is said that the Chicago Suburban Water and Light Company, which sold the Austin pipe system to Chicago never claimed that its property was worth $250,000, even while negotiating with the city. The company placed a value of a little more than $200,000 upon the plant and then asked that the city pay in adidtion the amount which the plant would earn for the company before the expiration of its franchise, which made the amount more than $300,000, at which figure the company offered to sell to the city. It is claimed that the officials of Chicago did not ask for information regarding the value of the pipe system to the city, but made inquiry regarding the cost of the pipes, hydrants, standpipes and other property connected with the system, after which it offered to pay $250,000 for the system. This offer was meant as a compromise, but it was accepted so quickly that the city officials felt some surprise. An investigation of the contract will be made.

Plans for Buffalo's New Water Supply.

The report of Col. Thomas W. Symons, Gen. George S. Field, and Rudolph Hering, who were engaged by the city of Buffalo to investigate that city's need of better water supply facilities, submitted a report to the board of aldermen October 10. They recommend a new pumping station, intake and tunnel, changes in force mains and valves at present station, new large mains, high service serervoir, etc., at a total cost of $2,800,000. They also urge the city to generate its own electric power for driving the electric pump, and water meters to stop the waste of water.

Fire Department Water Supply.*

By CHARLES ARTHUR HAGUE, New York.

At the present time in this country, at least, and in a majority of cities and towns large and small, the most powerful and effective weapon of the fire department is the steam fire engine, with a capacity of some 600 gallons of water per minute.

Such a piece of mecnanism, mounted upon wheels for ready transportation to the point of usefulness, is an extremely interesting combination. The running gear was a problem, and much expensive study and experience was passed through before that apparently simple portion of the apparatus had been strengthened and proportioned so as to carry safely from two to three tons of weight at the highest attainable speed of three powerful and excited horses, passing over and through any and all obstructions at a rate sufficient to wreck any ordinary running gear carrying half the load. Then the development of the steam boiler, to give so much power with so little weight, combining quick initial steaming qualities with fairly good staying ability. Then the peculiar adaptation of the steam engine, occupying so little space, giving high proportionate power with so small an amount of material. Then last, the steam fire engine pump is one of the highest developments of hydraulic devices. It has great abilities in the line of getting the water in and out again under high speed, either under the pressure of a hydrant, or up the length of a 20-foot suction hose, and putting this same water under a pressure of sometimes 250 pounds and sending it through a thousand feet of hose.

Not so many years ago a general view of our larger cities disclosed a rather uniform level of roofs, averaging perhaps six stories in height of buildings. Manufacturing establishments were very much more moderate in dimensions at that time than at present. But when the development and introduction of the passenger and freight elevators has removed restrictions from the height to which modern buildings may be permitted to go, it will be seen what a serious proposition is before the firemen and boards of today.

*A paper before the League of American Municipalities.

Further than this, the manufactory now considered to be needed for the demands of business, spreading as it does in many cases, over acres of space, coupled with fairly good height, will emphasize the modern ideas of more water, greater pressure, larger mains, prompt service, larger units of apparatus.

The general idea of today is to get at close quarters with a fire and put it out as speedily as possible; taking the hose into the burning building and fighting the enemy upon his own ground.

When, however, as unfortunately happens, a fire gains considerable headway in a large building amongst very combustible material, and is therefore all ready to spring into formidable dimensions just as soon as the necessary vent and air supply is furnished, within the space of a' very few minutes, or even seconds, the blaze is beyond close control and huge masses of water must be forthcoming, either to save a portion of the structure or to confine the damage to the destruction of the original premises.

Fires in five or six-story buildings with say 50 feet of frontage, are encountered in many of the smaller cities, and of course require practically as heroic treatment in one place as in another, with the difference that in a small or moderate sized city the proportionate danger of a disastrous conflagration is much greater, for the reason that the department available and the number of steamers at command are in proportion to the population and business importance of the community. In many cities where, say, ten steam fire engines mark the limit of the department, a fire could easily occur, which would require thirty engines to ensure a reasonably quick putting out of the flames; and such a fire getting beyond control would mean the configration which every now and then visits communities.

As an example, New York can concentrate thirty engines within an hour and repeatedly does so at what might be called a moderate fire for New York, but one which would be considered a threatening one for smaller cities. It is a threatening fire for the smaller cities only because the number of fire engines is limited to the population and general size of the city, and it is not a threatening fire for New York only because the enormous concentration of engines needed for quick suppression can be accomplished. In New York, with all of the facilities at hand for the work of the insurance patrol, and with fire risks and water damage closely watched, it can scarcely be supposed that too much water is used at fires, and if thirty engines or so were not too many at the Express Building fire in Lower Broadway last year, a similar building in a smaller city, with only ten or twelve engines at command, and with a high wind blowing, could very easily become the beginning of a great conflagration.

The logic of the conflagration question seems to be that a city naturally too small to maintain its fire department upon a conflagration basis, must take its chances and must endeavor, by superior discipline, watchfulness and effectiveness, to try and offset the lack of superior force naturally belonging to the larger cities. And, in following out this idea, it should always be borne in mind that there are buildings in both large and small cities of sufficient dimensions to start a conflagration, and that upon equal terms of handling a fire department, the risk to the smaller cities is increased in very much greater proportion than the natural lack of apparatus.

Aside from the very great importance of the knowledge of various buildings within the reach of the department, there is also necessary a knowledge of the water mains in the streets as to size and capacity. In a recent investigation made by the writer as to the capacity of water mains for supplying the fire department in a certain city, pressure gauges were applied to the hydrants in the districts in question during the busy part of the day, and after allowing a drop in the pressure which it was reasonable to assume might be permitted to take place, the well known laws of the flow of water through pipes pointed out that a great deal more water than could possibly be taken by the engines of the entire department could be caused to flow by difference in pressure observed and assumed. A fire which occurred soon after in the business district clearly demonstrated that the water supply was abundant, that the flow predicted would actually take place, and the information obtained by the fire department as to locating engines and the certainty of the flow through the different mains was, and is, extremely valuable. And from this it would seem that a map of water mains and fire hydrant connections giving the flow and capacity of the various pipes, and the consequent advantageous locations of fire engines, might be of value and use to the fire fighters upon frequent occasions.

Another extremely important question in meeting the threatened spread of a fire is whether there is enough water and pressure in any certain main or series of mains to enable the maximum number of fire engines likely to be needed in service in any certain neighborhood to pump to their full capacity, and this can be

ascertained only by pressure tests, and calculations covering the conditions involved. For example, and to state a simple case, supposing a supply main from reservoir to be 3,000 feet in length and 24 inches diameter, down to a point where an 18-inch main branched for another district to be supplied. Then, supposing that ten fire engines, each pumping 500 gallons per minute, could be distributed along the branch main, the first hydrant 250 feet from the point where the 18-inch main left the 24-inch main, and each of the hydrants 250 feet apart along the branch main. Also suppose that 1,500 gallons per minute would be the extreme requirements for domestic service, or say 100 gallons per day for 20,000 people. Then if the branch main also had a length of 3,000 feet, the first thousand feet would need to be 18 inches diameter; the second thousand feet 16 inches in diameter; and the third thousand feet 14 inches in diameter. These sizes and lengths would be necessary to keep the friction losses in the flowing water for the steamer and the domestic demands, within 13 pounds per square inch at the end of the 14-inch section.

In actual service the presence of cross connecting mains, laid upon the "grid-iron" plan, would of course modify the above stated results, and the example is confined to one main so as to make matters clearer. Recording pressure gauges giving records of water pressure covering reasonable periods of time will greatly help in getting information, and give a clearer knowledge to the fire department as to what can be expected in the way of water supply in any certain district. From proper information the best distribution of the engines so as to produce the best and most effective work upon a fire would be quickly apparent. After clearly grasping the idea as to the possibilities and practicable capacity of the water mains for use in fire service in certain districts of a city, the next step in the matter would be to find out the full capacity of the steam fire engines likely to be used, and what it would be necessary for them to do to ensure the proper fire protection of the districts under consideration.

But aside from the performance of the engine itself, the man behind the pipe is at the point of real execution, and what he actually gets to do the business with is what counts.

Of course, steam economy does not figure in a fire engine, as the absurdity of reaching after steam economy for a few hours, at the expense of greater weight and complication, and with a $500,000 fire loss threatening, is apparent without much study. What is required of a steam fire engine is to deliver a large quantity of water, without running at such a speed of revolutions that a large percentage of the power is lost in opening and closing the pump valves and in by-passing the water through them. And it is also required to use the power in sending out a large quantity of water under a moderate pressure at the nozzle, say from 70 to 80 pounds, the nozzle being of a liberal size, rather than producing a great water pressure at the pumps by using a small nozzle. It matters not how many revolutions the engine may be making, or how much water pressure may be said to exist upon the gauge at the pump, or how long or how short the lines of hose may be, the actual pressure at the nozzle governs the real discharge of water. Under good conditions, with two lines of hose, each 300 feet long, regular 2 1-2 inch rubber lined fire hose, with 80 pounds pressure at the nozzles, 1 1-4 ring nozzles, both lines will deliver 540 gallons per minute, and the work will call for a water pressure at the steamer of 170 pounds. Such streams would enter a burning building at an elevation of 100 feet with great energy.

Direct water pressure at the hydrant, although under some circumstances admissible, in cities of smaller sizes, is a system to be handled very carefully. There are many cases where the fire department has been hopelessly crippled at a critical moment. One of these cases was where a sprinkler system in an oil mill opened up and so bled the street mains to which the sprinkler system was attached, that the firemen were unable to get any streams worth mentioning from the hydrants. The sprinklers failed to put out the fire at its beginning, and the mill burned so that the supports of the sprinklers and pipes fell and wrecked the system, leaving numerous openings of two to three inches in diameter and, there being no shut off for the supply in the street mains, the hydrants were useless for fire service; the loss was about $50,000, a rather expensive experience.

In some cities where the direct system is used, or attempted to be used, a reserve is maintained consisting of a steamer or two, but often by the time the fire department realized that the steamers were necessary, the fire was master of the situation, the delay and uncertainty in getting the apparatus at work adding to the general discomfiture and misunderstanding. There have been some heavy fire losses, where direct hydrant service had been too much depended upon, sometimes because the lines of hose were so long that the friction in the water prevented adequate pressure at

the nozzles; and sometimes because, however prompt and high the water pressure at the pumping station might have been, the restricted diameter of the mains in the streets practically destroyed the enegy of the streams.

All things considered, in most cases, the steam fire engine with its 2 1-2-inch hose, provides the most general and reliable means of fire protection in moderate sized as well as in the larger cities.

The pressure once fixed and limited at the pumping station or reservoir, every foot which the water travels before coming out of the hose nozzle takes toll in friction, with the result that the firemen are compelled to take what is left.

The feature of high pressure mains for fire service, in use in some of the lake cities, lately introduced into Philadelphia, and now seriously talked of for use in New York, will, no doubt, in the future form a valuable means of concentrating a large fighting force, with plenty of water, at threatened points. The best method for using the necessary power is not yet decided and probably will not be decided for some time to come. There seem to be three phases of the power question for a stationary pumping plant for this high pressure fire service with special mains, as follows:

Steam Power. Very reliable, but under the necessity of the banking of fires through considerable periods of time, especially in a moderate sized city, but this would not be so much of an objection in the larger cities where fires are comparatively frequent.

Gas Engines. Not under the necessity of keeping up fires or steam during the unused period of time, but depending upon gas supplies from ordinary city mains and subject to certain minor uncertainties in operation. The gas engine as a means of power is well established in manufacturing and in very many situations of an industrial nature, but where derangement or stoppage would be measured by small loss. But the question has not been completely settled in its favor for the very important emergency of fire risks, notwithstanding the ardent and sincere advocacy of the gas engine for this work, upon the grounds that because such engines are successful in other places, they ought to answer for fire service, regardless of the vast apparent difference between an emergency service which must be absolutely sure and a steady and uniform service which may stop now and then with comparatively little damage.

Electric Motors. The electric method of transmitting power has been fully demonstrated for transportation and for industrial uses, and fits many such situations most admirably but is open to the criticism of the gas engine, in that it would most likely have to take its electricity from the street wire or feeder, and obtain its supplies of energy from a distant source of power, to say nothing of certain features of the special form of pump to which the electric motor is best adapted.

To put the three modes of power upon an equal basis of reliability as probably considered by the fire insurance companies, the proposition would look about as follows:

Steam Power. Banked fires and men on watch all of the time when not at work, with quick steaming boilers of large capacity. To use piston steam engines and plunger pumps directly connected as in a fire engine or fire boat.

Gas Engines. A gas tank on the premises with gas enough at all times to operate the plant at least seventy-two hours; also a small electric generator, driven either by a gas engine or by a steam engine, for making absolutely certain the presence of the igniting spark.

Electric Motors. Either a complete generating plant to be operated by gas or steam engines upon the premises, always ready for instant use and if gas or steam engines are used for generating, a gas tank of reliable dimensions, or else storage batteries of absolutely reliable character, and with a safe capacity of 72 hours at least, and connected to adequate street feeders from two or more power plants, independently of each other.

The fire underwriters are extremely cautious as to methods more or less unknown and where electricity is employed look very carefully into the matter. The author remembers two places in his own experience where the fire underwriters took a very decided stand regarding the use of electrically transmitted power. In one case, in the state of New Jersey, their restrictions amounted to prohibitive measures. And in another case in New York state, the cost of the plant was greatly increased by certain requirements to insure reliability, one of their precautions taking the form of stipulating a double line of poles and double conductors to the power station. This double requirement was looked upon at the time as extreme and exacting, but within one year a flood and ice gorge completely wiped out of existence for several days one of the feeder lines for a length of 2,000 feet or more, and came within sixty feet or so of demolishing the only remaining line. The precaution of keeping an auxiliary steam plant constantly ready for use was also looked upon as extreme, but the continuous attack of the heavy ice floe for a few hours longer would doubt-

less have brought the steam reserve into action. Before this plant was put into place, its advocates were very ardent and absolutely sincere in their belief of the certainty of its work, and scouted all ideas of any possibility of failure; and yet when first installed it was an absolute failure in many respects, but the far seeing wisdom of a very practical nature possessed by the fire underwriters, although they possessed no great technical knowledge of pumps and motors, enabled them to put their finger upon the precise point of risk, although it must be confessed that a little broader engineering, upon the part of the builders, would have tended toward the same point of view.

It would be very interesting if it were possible to accomplish, to strike a balance showing just about what a city could afford to pay for fire protection, by canvassing the cost of insurance against the investment and operating expenses of a properly equipped fire department. It would require considerable study, of course, but in the modern tendency toward high buildings, either the buildings must be made practically fireproof, or slow burning, at least, or else sufficient pressure and quantity of water must be promptly at hand when fire occurs. It is often difficult for chiefs of fire departments to get sufficient funds from their boards of commissioners to do necessary and very desirable improvements, and also difficult for the boards to convince their superiors in power sufficiently to place funds in their hands. Finally the question gets back to the buisness community and there it goes napping. But it seems to the author that if the business men of a community could have the true relation between insurance, fire losses, and costs of fire departments actually brought home to them, so they could clearly grasp the subject through the medium of accurate figures, the way would be easy. Sometimes the business man does not have the question brought home to him but in the light of a fire burning his own property, and then he rubs his eyes and wonders why he did not do something about better fire protection.

With the use either of electrcity or of gas engines, for motive power for fire pumps, if the regular displacement pumps are used, such as are used in waterworks pumping engines or in fire boats and steam fire engines, the use of gearing must be resorted to, which, of course, brings into the problem the most objectionable form of pumping apparatus on account of the high speed of the motor and the limited speed of the pump. The turbine pump has of late been rapidly coming to the front for heavy pressure work, and is eminently fitted for the use of either gas engines or the electric motor, but it has not yet won its spurs and unless its efficiency can be very materially increased, the displacement pump, with its steam drive rigidly connected with steam pistons to water plungers, will hold its own for a long time to come.

It would also seem that with the high pressure system for protection against fire, the hydrants would need to be located nearer together than in the ordinary system where fire engines take water from the hydrants; and this, for the reason that a fire engine can regenerate the pressure needed to meet any length of hose, according to the distance the engine may be away from the fire, while, with a fixed pressure at a pumping station, even though the pressure may be pretty high, the quantity of water is lessened with the lengthening lines of hose; besides this, hydrants are cheaper than hose, and the main pipes in the street carry the water nearer to the fire with very much less loss in friction than the loss in hose friction. Two hundred and fifty gallons per minute flowing through 300 feet of regular fire hose, 2 1-2 inches in diameter, would produce a friction loss of 67 pounds per square inch. Five lines of hose would deliver 1,250 gallons per minute with this loss of friction of 67 pounds between the hydrants and nozzles, supposing all five lines to lead from the same hydrant. But, to bring this quantity of water one mile, or 5,280 feet, through a 12-inch main to the hydrant would make a friction loss of only 10 pounds per square inch. Therefore, the logic seems to be in the direction of large hydrants with numerous outlets, having independent valves and, in a thickly built up business or manufacturing district, have these hydrants comparatively close together so as to save hose and keep down the hose friction.

Where a high pressure system for fire protection is installed, it should be made and kept entirely independent, and exclusively for fire service, the author not believing in connecting even sprinkler systems to the high pressure system, as the breaking of a sprinkler connection in a burning building would very likely bleed the fire system so as to rob the high pressure outfit of its very reason for existence. One of the chief values of the new high pressure idea is its exclusiveness from use in any other field. Many shortcomings have been seen in the combined domestic and fire systems, wherein the regular waterworks supply pipes were used for fire service by simply raising the pressure. In fact, the simple difference between the exclusive

use of a set of pipes for fire service, and the combined domestic and fire uses, might very easily mean the success or failure for the system throwing fire streams directly from hydrants without steamers.

Very great improvements can be made today, in many cities, by a rearrangement of water mains, so that the fire department can get a liberal supply of water, even with the present fire engines and hose.

There are many cases in which too many engines have been endeavoring to take water from the mains of capacities far below the draught put upon them; and where a less number of streams more active in quality would have done better work upon the fire. Four engines with energetic streams under good working pressure will throw just as much water on a fire as eight engines with weak streams and low pressure; and the active streams are immeasurably more valuable for fire fighting. The reason is not far to seek, and it is this: The discharge of water increases very rapidly with the increase in the head or pressure. Therefore, it follows that under a higher pressure the discharge increases so that the lesser number of openings will throw the given quantity of water and at a greater velocity. Or, the reverse of this proposition is, that with more opening, less pressure is required to send out the given quantity of water; and the matter adjusts itself in the question of streams of water automatically and to the utmost nicety, to correspond to the pressure. It does very little good to simply spill water into a building upon the floors; the floors are the last places to catch fire; but searching, dashing streams, capable of delivering more water at any one spot in a certain time than their weaker neighbors, will hunt out the corners and ceilings and give a good account of themselves.

Water Can Not Be Diverted from New Jersey Streams to New York.

A decision was rendered in favor of the State of New Jersey, August 22, by Vice-Chancellor Bergen, who enjoyed the Hudson County Water Company from diverting the waters of the Passaic river at Little Falls for supplying the needs of Staten Island. The suit was begun by Attorney General McCarter last winter, under the Bacheller act. The vice-chancellor dismisses the constitutional question raised by the defendants as being entirely without weight, and holds that the State may rest its claims upon the broad principles of public policy and the protection of its subjects in their common rights and without regard to the statute under discussion.

The vice-chancellor, after reciting the facts connected with the contract by which the East Jersey Water Company agreed with the New York and New Jersey Water Company to furnish water for Bayonne and Staten Island, says:

It is admitted that the Passaic river is the most important of the available sources of water supply for the people of New Jersey, a necessity for the use of which is constantly increasing; that the present available supply of water in the Passaic river is largely in excess of the present consumption by New Jersey inhabitants, as now supplied, and that the defendant had incurred large expense in laying mains, and doing other necessary work to enable it to take the water to New York State previous to the adoption of the statute now under consideration.

After reciting the act which was signed by Governor Stokes on May 11 last to prevent the diversion of the potable waters of the State, Vice-Chancellor Bergen continues:

The information is filed by the attorney-general and seeks to restrain the defendant from taking waters, diverted from the Passaic river, into the State of New York, for use therein. This the defendant admits it intends to do, in violation of the terms of the act, alleging that the act is void, because (a) it impairs the obligation of contracts in force when the act was passed; (b) it takes property without compensation; (c) it provides for an interference with commerce between the States; (d) it denies to citizens of other States the privileges of citizens of this State, and denies them the equal protection of the laws of New Jersey; (e) it is in violation of the constitutions of the United States and of this State.

The question is thus presented, can the defendant, through the East Jersey Water Company, or by other means, divert from the Passaic river, free from any control or regulation by the State, whatever quantity it may desire of the fresh water running therein and carry it to another State, the consent of parties in interest, other than the State, being assumed?

The statement of the proposition indicates the serious import of the matters involved, for, if the contention of the defendant expresses the law, persons and corporations may, by acquiring the private rights in any running stream, obtain such an ownership in the water passing down the stream as to permit its total withdrawal, and transportation to a foreign jurisdiction, leaving the citizens of this State entirely destitute of a natural, and necessary element of life, so far as the same may be derived from streams supplied from the running surplus, or overflow, of water from lakes, ponds, springs and other natural sources of potable water.

If the public have any common rights in or to the running waters of our rivers and streams at any point, during its flow to the sea, such a right is manifestly held by the State in trust for the public, and it, by virtue of its sovereign power, may grant or restrict the appropriation thereof, so long as it does not interfere with the reasonable rights of other owners of

land over which it flows, and any unauthorized diversion of such water above the point where the public rights appear, is a wrong of which the State may justly complain, and seek to restrain, and the fact that it has not heretofore objected, is no reason why it may not now protest against a further spoliation of public property. It may lawfully permit its own citizens the benefit of property held in trust for them, and at the same time limit such permission to those who have a common right therein.

In my opinion, running water having served its transient uses as it passes by, comes to the lands of the State freed from any charge on behalf of the upper land owner, except such as he may have as one of the public, and that it is the duty of the State to guard its riparian rights as zealously as does the individual. Being convinced that the State, as the lower riparian owner, has the right to have the water of streams flowing into tidal rivers reach its property undiminished in quantity within the rule above expressed, I can see no reason why it may not regulate and control the matter of the disposition of its property rights, for acquiescence in the diversion of water, which or right ought to flow to its lands, is a surrender of property interests, the extent of which it may limit.

The objection that the questioned law is void as a violation of the federal constitution regarding interstate commerce does not appeal to me, for we could not consistently say that an effort on the part of the State to preserve the common property, whether in the interest of navigation or for the domestic uses of the public, after it had satisfied the proper private charges against it, could be frustrated simply because the unlawful abstractor of its property intends to transport it into another State. The defendant and those under whom it claims are corporations organized under the general corporation act of this State, which I cannot discover confers any right to carry on this business other than it is a "lawful business.'" Certainly there is no grant of any power, or right, under which it can be said the State has abrogated any of its rights in the running waters of the State, or authorized these corporations to divert from its proper channel and water course the common property of the public, and my conclusion is that the law assailed does not violate constitutional requirements, either federal or State, and being a mere regulation of the extent to which a diversion of public property, permitted, but not given, may go, is valid legislation.

Whether this act be valid or not, under the view I take of this question, the State may rest its case upon general principles, and does not need the support of the statute under review. The State has a duty to perform in that it must protect its citizens against the assumption by individuals or corporations of any of its sovereign rights, or the conversion to private use of such common property and rights as the State is said to hold in trust for the public use, the loss of which may destroy the health and comfort of its subjects. The policy of the law is to assign to everything capable of ownership a determinate owner. If capable of occupancy and susceptible of private ownership and enjoyment, the common law makes it exclusively the subject of private ownership; but if such private ownership and enjoyment are inconsistent with the nature of the property, the title is in the sovereign as trustee of the public, holding it for the common use and benefit.

After citing a number of decisions relative to the rights of the State and of individuals in running water, which, as far back as the old Roman law was looked upon as common property, the vice-chancellor continues:

The position of the State is different from that of other riparian owners. Large bodies of fresh water, which have already served the proper purposes of private riparian owners above the lands of the State, are received on common property, forming great reservoirs of a valuable natural element, necessary for the health and comfort of all the people, and in which every vestige of private right, subject to which the common right is held, has been extinguished, for the State being the last riparian owner, has no other to account to, the owners of the upland along tidal waters having no rights therein, and the State should be considered as the ultimate owner of such unusual common property, to be held in trust for the use of all its subjects.

The constant increase in our population, considered in connection with the unchanging extent of our watershed, and the consequent limit of the natural supply of water necessary for domestic and healthful purposes, may justly alarm the State with regard to the future, and a neglect to insist upon its rights in the past, when conditions did not require a strict enforcement of its privileges, works no estoppel, and justifies the restriction of the appropriation of its property.

It is admitted that the Passaic river is the most important of the available sources of water supply for the people of New Jersey, and that their necessity therefore is constantly increasing.

The State has a right, unless it grants it to another, to the ultimate disposition of what remains of all waters which naturally empty into a tidal stream, after the transient rights of riparian owners have been exhausted, and no one has a right to divert the water for commercial purposes, without the grant of the State, in the absence of which, such abstraction is the conversion of public property without legislative authority. The State may grant this right, but until it does it should be held beyond the reach of private appropriations. That the permission of the State to divert from the Passaic river water for private consumption has been recognized, is manifested by the act authorizing the construction of water works for Jersey City.

The defendant insists that as the threatened action will not now actually absorb the river, because there is yet a surplus of water not drawn and taken for New Jersey consumers, the State must wait until the diminution is appreciably affecting its citizens, but that argument does not meet the principle involved, which is, can the State regulate the diversion and application of running water which naturally empties into tidal streams, having due regard to the rights of riparian owners? The answer must be that it has, thereby conserving the common interest of its people, otherwise private enterprise may remove all potable water, and sell it in another State, disregarding the riparian rights of the State and divesting it of its proper ownership in all surplus waters

which undisturbed would come to its possession.

My opinion is, that, subject to the lawful transient rights of riparian owners along the banks of running streams the waters of which finally empty into a tidal stream, there is vested in the sovereign power the right to insist upon the proper riparian use of the waters therein in order that the common right to the use of the residue, which is not private property, may be preserved for the benefit of those to whom all common property belongs, nor would the grant of every owner of land along the stream, from its source to tide water, affect the right of the public, for that only can be granted which the grantor hath, which is the transitory usufructory use, subject to which running water is *publicis juris*. As the threatened act is an invasion of a common right, in that it will result in the removal from the State of the common property, it has a right to protest against the proposed increased diversion, and should seek to protect the public estate.

Other questions were discussed on the argument, but I prefer to rest my conclusions on the reasons I have given, for I am satisfied that the State, in its sovereign right as owner of the bed of all tidal streams, becomes the owner of all fresh water flowing upon its land, and that any interference with the proper flow of such water, resulting in a diminishment of the natural quantity, is the subject of equitable interference, and also that the corporation act, under which the defendant and its agents exist, grants no right in derogation of public ownership of such water, and that without such grant the taking of water from running streams for commercial purposes is, as against the State, a wrong to be restrained, and that the restraint may be limited to such takers as the State may elect. It is perhaps pursuing a just policy when it permits, without objection, the taking of its property to be served to its people, but it cannot be compelled to the unauthorized extension of its gifts to citizens of another jurisdiction.

REFUSE AND SMOKE

Portable Refuse Destructors—Smoke Abatement.

Portable Refuse Destructors.

In a comment upon the note in MUNICIPAL ENGINEERING, some months ago regarding the invention in this country of a portable refuse or garbage destructor the editor of the *Surveyor and Municipal and County Engineer*, of London, rather facetiously calls attention to an article in his journal upon the same subject, from which the following is taken:

Coming now to destructors of a portable type, the Horsfall Destructor Company, Limited, has designed one specially to meet the requirements of districts which are too thinly populated to justify the expense of a destructor of the usual type, and also for camps and similar purposes. It consists essentially of three parts—the destructor furnace proper, the boiler and the smoke-box (the last-named containing a dust-catching arrangement—and it is provided with patent forced-draught apparatus and side air-boxes, which heat the blast and protect the furnace sides from clinker, and with a by-pass, in the form of an independent chimney, for use when the whole of the heat generated cannot be utilized in the boiler. The boiler is of the multitubular type, and is provided with the usual valves and other mountings. It supplies steam to the steam blowers, and is also provided with a junction valve, to which could be coupled the steam pipe of an engine for doing any useful work about a town's yard. The dust catcher in the smoke-box is of an ingenious type, by which the current of gas is forced downward, so that the dust is thrown upon the floor of the chamber. A steam jet is provided in the chimney to induce the draught when required. The destructor can be easily moved from place to place by two or three horses or a traction engine or steam roller, and will readily burn six tons of refuse per twenty-four hours. It requires no buildings, foundations, approach roadway or high chimney, and it works without any nuisance, and is easily attended to by one man.

The portable destructor manufactured by Messrs. Meldrum has a destroying capacity of five tons per day. Forced draught is provided by means of two steam jet blowers, the steam for which is supplied by the multitubular boiler, which is combined with the destructor. As only a proportion of the steam generated is required for the forced-draught blowers, the surplus steam available may be used for driving a small engine or for other useful purposes. The facts that destructors can be made in very small sizes and that they can be made portable point to the reasonableness of regarding the hygienic disposal of the refuse of small towns and villages as no less essential than the proper disposal of sewage.

The Abatement of the Smoke Nuisance.*

By R. P. KING, Smoke Inspector, Indianapolis, Ind.

Papers on the suppression of the smoke usually deal with the mechanical devices, which, to a greater or less extent, prevent the emission of smoke from the chimneys of steam generating plants.

*A paper before the League of American Municipalities.

The writer will, in this paper, touch upon some of the municipal methods of abating the nuisance, particularly in those cities located in the middle west.

Black smoke, or soot, is, of course, unconsumed carbon, which may be present in greater or less quantities, usually, however, far less than is commonly supposed. The cause of this objectionable smoke may be summed up in a single sentence, as it is due to one or both of two causes —unskillful manipulation of the fires or a furnace not suited to the coal.

While the actual loss by unconsumed carbon may be small, the mere presence of smoke indicates other losses which may be great. These losses are: 1, carbon monoxide; 2, unconsumed hydrogen; 3, excess air; 4, insulation of tubes by soot. The losses from these causes may be as high as 50 per cent., and will bear no relation to the actual loss from unconsumed carbon. The remedy for these conditions is in the hands of every competent engineer and the cure is effected by the use of various well-tried devices.

The actual loss in fuel economy falls where it should—on the shoulders of the man that produces the smoke; but there are other losses that are imposed on the public that can not be so lightly passed over. There are enormous losses from depreciation of property, injury to the general health, the increased cost of painting buildings, and the injury to delicate merchandise, not to speak of the extra washing and scrubbing necessary to remove soot and grime.

The smoke nuisance is a condition at present intimately connected with the soft coal district, but as the supply of anthracite coal is limited, the problem will, in a comparatively short time, be general.

Many cities in the soft coal district import so-called smokeless coal, for use under certain conditions. Some apartment houses and public buildings have found that this coal is so much cleaner to handle, that it is cheaper for them to burn it, than to try to use soft coal at a less price.

Owners have a deep-seated prejudice against smoke preventing appliances and especially against the more expensive one, the business being looked upon as a fake and compliance with the smoke ordinance a hardship, to be complied with at the least possible expense.

The cities adjacent to the coal beds of Ohio and Pennsylvania are better off than those near the Illinois coal beds, as these eastern coals are less difficult to handle and the distance from the anthracite regions is not so great as to make the use of this fuel prohibitive.

The serious problem of preventing smoke from residences can only be handled through the use of the smokeless coal or the central heating plant. This latter makes a happy solution of the problem for the city smoke department, as there is less difficulty handling one large plant, operating under a franchise, whose chief expense is coal, than when handling several hundred small consumers.

A good smoke prevention ordinance should—1, declare smoke a nuisance; 2, fix the responsibility for violation; 3, fix the authority and duties of those having charge of its enforcement; 4, contain an alteration clause; 5, provide a permit clause and fix fees; 6, provide a penalty.

In fixing the responsibility the burden should be divided. The burden of originally making the plant a non-smoker should be on the owner—that of keeping the apparatus in repair should be on the employee.

The authority of the smoke department should be definitely fixed, but the duties should be outlined in a general way only.

It seems to the writer that the alteration clause is the best way of primarily attacking the problem. In this case a certain time is given, during which time the plants are supposed to be changed. With a permit clause in effect this will give the chief of the corps an opportunity to watch conditions and collect data before prosecutions are in order.

In fixing the fees, $5 for new installations and $2 for repairs seems to be the usual charge for each boiler.

The personnel of the department is of great importance as the suppression of smoke is in reality an engineering work of no small magnitude. The work of collecting data, ordering changes, supervising new work, and instructions requires a man of technical and executive training. He should be competent to conduct tests, to make analyses, be of wide practical experience, diplomatic to a degree, and of unimpeachable integrity. His title should be that of engineer and his position must be one of dignity. Such a man can command an ample salary and a corresponding one should be attached to his municipal position. Under him should be a practical fireman, familiar with the care and operation of the various smoke preventing devices in use. The work of making charts, photographs, prosecutions, etc., may be acceptably done by any one having received a certain amount of instructions.

The department should be located in commodious quarters and equipped with all necessary apparatus. This will include draft gauges, pyrometers, indicators and analytical apparatus. For measuring draft the U tube is commonly used and is sufficient for any but the more re-

fined work. For measuring the furnace draft a Barrus gauge is acceptable, although the furnace draft may be tested by means of a candle flame, while an open handkerchief makes a reasonably accurate gauge for testing the ash pit draft.

Thermometers may be used for temperature to 1,000 degrees Fahr., and may be carried by all inspectors at all times. For continued measurements an electric pyrometer is used, which is reasonably portable and may be used to 3,000 degrees.

The Orsat apparatus is generally used to make flue gas analysis and, as it is reasonably portable, may be carried from place to place, as necessary. For coal and water analysis, other apparatus of a purely chemical nature is required.

The writer has never found any reliable data concerning the steam plants visited and inspected. Many employees do not know the size of the boilers under their charge; coal consumption is a thing to be guessed at, monthly coal bills being the best information obtainable. I know of but one plant in Indianapolis that keeps a daily record of coal burned and not a single instance of a reliable and complete log being kept.

I have spent much time compiling data and conducting tests, with the sole idea of providing for the steam users of Indianapolis reliable data upon which to base future calculations.

The following table is partly the result of these tests.

PROPORTIONS.

When designing or altering furnaces, the following general rules should be observed:

Minimum height of chimney, 75 feet (this height only when chimney sets on smoke-box; allow extra height to compensate for losses in horizontal flues and right angle bends).

Allow 5 pounds of coal per rated horsepower.

Estimate the grate area on a consumption of not less than 20 pounds of coal per hour per square foot. This gives for a 100-horsepower boiler 25 square feet of grate area. If possible, increase the draft to reduce this area to 20 feet.

Vary the grate area for boilers in the same battery, increasing this area as the distance from the chimney increases.

The following ratios are approximate, but are in accordance with the above rules.

Grate area to heating surface, from 1:45 to 1:60.

Grate area to area over bridge wall, 5:1.

Grate area to area across tubes, 6:1.

Grate area to area across breeching, 6:1.

Grate area to chimney area, 7:1.

I found the best results with bituminous coal to be when running with a high rate of combustion.

A hot fire can only be produced by a high rate of combustion, and a hot fire is the only smoke preventing condition. Our department recommends a rate of not less than 20 pounds per square foot, while 30 pounds is excellent, and get 40 pounds if you have the draft. Under these conditions smoke prevention is possible and economy is assured.

The collected data of the department should be given at times to the steam users, through the medium of bulletins. Several smoke departments are using this means of education. The bulletins should be short, not too technical, and to the point. The newspapers may be of great assistance in a smoke campaign, but this help sometimes is of doubtful character.

If their artillery could be brought to bear on the people who make the smoke, instead of worrying those that are trying to prevent it, more real good might be done. By all means advertise the work through the newspapers, for it makes the people talk if nothing else.

To the salesman can be handed the banner for assistance in educating the smoke maker. Of course, they exploit their own goods and perhaps the merits of their devices lose nothing by their explanations. Still, the work of this class of men is doing a great deal of good by informing the owner of the principles and practices of good combustion.

Manufacturers are the life of most of our smoky cities, and to antagonize them needlessly means ruin to the common interests of that city. As mercy should temper justice so common sense should leaven the work of the smoke inspector. Here is an enterprise in the hands of a receiver; labor with the receiver to buy better coal. What else can be done? The court can not be sued. A large plant was offending badly. It was a large, ultra-municipal corporation. The matter of improvement was taken up through the firm that made the devices in use and the plant cleaned up in a month without suit or hard feelings.

Of course, all cases can not be handled by diplomacy, and for such there is the heavy hand of the law. In collecting the evidence for prosecutions the best way to illustrate the condition is by charts. On these charts vertical spaces represent degrees of density of smoke and horizontal spaces represent time. By this means a continuous record may be presented to the court, which may be supplemented

by photographs. I have never had evidence of this character disputed. Appealed cases are more difficult, for there enters in the question the legality of the law, reality of the nuisance and possibility of complying with the law. These points are not, however, difficult to prove.

In attempting to comply with the letter of the law, owners advance all sorts of wild ideas that have been tried and modified for years. With these may be classed a large number of fake devices that have not proven satisfactory to any one except the contractor. For experimental work, the writer requires detail drawings and in some cases where the device resembles a perpetual motion machine, a mathematical demonstration. These usually serve to head off the fake. An unsuccessful device once installed is worse than none at all, and an attempt should be made to make every installation a complete success.

Of the successful devices there are four classes—1, steam jets; 2, furnaces; 3, mechanical stokers; 4, smokeless coal.

Steam jets are an uncertain quantity and while eminently successful in certain plants, for some unaccountable reason the same machine fails in others. In order to be of value the steam jet must meet certain requirements. 1, It must be correctly installed; 2, It must be automatic in action; 3, It must admit a sufficiency of air at the instant of firing.

Steam jets are not adapted for boilers larger than 125-horsepower, nor should they be used when more than three boilers are connected to one chimney.

When properly designed the smokeless furnace gives smokeless combustion and a high efficiency. One peculiarity of these installations is that the harder they are pushed the nearer smokeless they become. Their successful action depends on a high furnace temperature and to that end the grate area must be reduced and the draft increased; the fire box must also be roofed in with fire brick. It is not unusual to maintain a rate of 30 pounds per square foot of grate in these furnaces.

Of successful stokers there are four general classes. The underfeed, in which the coal is forced up under the fire, has been successful with cheap coal.

The inclined grate stoker class may be divided. The most successful is the rearwardly inclined stoker, in which the coal is fed into a hopper and then forced by gravity forward over a series of steps.

The side inclined stoker differs from the above in that the magazines are along the sides of the furnace and the coal is slid along plain inclines instead of steps.

Of the traveling grate type there are many stokers, differing only in minor details. These stokers are the most successful smoke preventers, but are not adapted to fluctuating loads.

There is little to be said about smokeless coal. In the soft coal regions the use of smokeless coal should be limited to residences. In Indianapolis, for instance, smokeless coal has no business under a steam boiler, as our cheap native product can beat it 2 to 1, owing to the difference in heat that can be bought for the same price.

The shaker grate has a field in the soft coal district. With a small grate and a high rate of combustion, a shaker grate is necessary and should be used in all furnaces burning bituminous coal.

While the rotary grate stoker is yet in the experimental stage, it seems to fill a need for cheap stoker or small installations. As the name implies, the grate is round, revolving bodily and coal is blown in with a steam jet.

The economy of smoke prevention is a well demonstrated fact. For instance, a smokeless furnace reduced a certain coal bill, 65 per cent., bringing the cost of 1,000 pounds of steam to 10 1-2 cents. This with coal delivered by wagon to a small plant.

Another firm with stoker equipment and track in the boiler room, gets 1,000 pounds of steam for less than 9 cents. A large power plant, fully equipped with stokers, gets the cost of power down to less than 1-2 cent per kw. hour.

PAVEMENTS

Effect of Water on Asphalt—Sioux City Viaduct—Grand Rapids Street Intersections—Allegheny Asphalt Plant.

Specifications Regarding Effect of Water on Asphalt.

Mr. Rosewater's article under the above heading, which appears on a preceding page in this number of MUNICIPAL ENGINEERING, was submitted to Mr. A. W. Dow for his comment thereon, and the following is from his letter:

There is but little to be said in answering Mr. Rosewater's reply, excepting to point out a few cases where it seems he has misunderstood me. In the first place, I must deny that I have ever admitted that the clause,

"If an asphaltic cement is accepted that is affected by water, some provision satisfactory to the Engineer Commissioner must be made to guard against the result of such action, and such work must be including in the price bid"

was designed to exclude Trinidad, but to the contrary it will be seen by referring to my criticism that I distinctly say:

* * * "We do not wish it inferred that good pavements have not been, and will not be, constructed with Trinidad asphalt, but to the contrary, as the clause indicates, we believe that by special treatment of the asphalt, or by some special construction of the pavement, this undesirable property can etther be entirely eliminated or so much so as not to be objectionable.

In quoting the report of Mr. Richardson made eleven years ago, my object, as is clearly stated, was to demonstrate that the "marked difference between the action of water on pavements constructed with Trinidad asphalt and other bituminous pavements is not at all new, and did not originate with myself," and was not done, as Mr. Rosewater infers, with the idea of making anyone believe that Mr. Richardson expresses these opinions at the present time.

While I do not consider it any great offense to change one's mind, the facts in the Peoria paving case are not correctly stated. I was not called upon to, nor did I testify in behalf of either land or lake asphalt, but was called to show that there was a difference between several samples said to be land asphalts submitted to me by the city of Peoria, and the asphalt known on the market as Trinidad lake asphalt.

I deny ever having written an article in which I indorsed Trinidad land asphalt as against Trinidad lake asphalt, and also deny that I have ever, in recent years, "concluded that neither of these asphalts is fit for paving" when properly treated. The article which Mr. Rosewater evidently refers to here is my report to the Engineering Commissioner of the District of Columbia for the year ending June 30th, 1902. Quoting from two parts in this article I say, "where one asphalt excels in one property the other excels in another, so there is but little choice." And again, "after a careful examination into the facts, I believe that little or no foundation can be found for the claim that lake asphalt is superior in quality for paving purposes to land asphalt." I then take up the objections to land asphalt that have been raised by the exponents of lake asphalt, and show by a consistent course of reasoning how they may be really turned to the advantage of the land asphalt, and further on I also state that land asphalt is superior to lake asphalt in that it is less acted upon by water.

In answer to Mr. Rosewater's statement that I condemn the use of Portland cement as a filler, I can only in denial reiterate my former remarks:

"The requirement of the substitution of Portland cement for powdered limestone is open to criticism, because the action of Portland cement as a filler has only been tried with Trinidad asphalt, and possibly Bermudez asphalt. It may be it is no better, and possibly less valuable, than powdered limestone dust when used with other asphalts, and is therefore an unnecessary additional expense."

As my criticism does not refer to the use of Portland cement as a filler with Trinidad asphalt, it cannot have been made in the face of any successful experiments. Portland cement has never been tried with any asphalt other than Trinidad, and possibly Bermudez, and only for a relatively short period of time, while there are in existence to-day many successful pavements made with limestone dust filler, some of which are twenty-five years of age and over.

The letter appears in this place, because it was received after Mr. Rosewater's article was on the press. The editor wishes to say that his reading of Mr. Dow's article in the October number was the same as that emphasized in this letter from Mr. Dow, and that he believes that much of Mr. Rosewater's criticism is based on a misunderstanding of the article referred to, which this letter should do much to clear up.

Sioux City Viaduct Questions.

The State Railroad Commission made an important ruling recently in the Sioux City, Ia., viaduct case. The commission declined to order the West Seventh street viaduct until certain streets are closed on each side of the viaduct, to insure public safety in that section over the high railroad crossing instead of at grade. The commission also requires that the street railway lines cross over the viaduct in-

stead of at grade on parallel streets. The commission expressly states in this latter provision, however, that it does not pass on the merits of the question whether the street railway company ought to be required to pay a portion of the viaduct cost. The commission also refuses, in the Sioux City case, to let the Great Northern cross the viaduct at grade with an elevated track.

Payment for Paving Street Intersections in Grand Rapids.

An opinion has been rendered by City Attorney Taggart, Grand Rapids, Mich., on the cost of paving street intersections, in which he holds that a system of averages in dividing the expense will not hold water, according to the new charter. The opinion involves the payment by the city of a larger share of the cost of improvements than had been contemplated in some quarters, and will increase the work of the engineering department and the board of assessors. Under the city attorney's ruling, it will not be possible to figure up the entire cost of the improvement, and then apportion the expense according to frontage, and the city paying only according to the width of the intersecting streets. This method can be followed only in the case of sand traps and other extras, which are manifestly for the good of the entire street, wherever they may be located. For paving within intersecting lines the city will have to pay the exact cost, which will figure in some instances quite a little higher than to pay on the basis of averages. The chief reason for this is that in paving one street the city has followed the practice of paving the approaches of all intersecting streets. In cases of streets which end blindly the calculation of the city's share will be somewhat further complicated. The city attorney holds that in such a case but half an intersection shall be recognized.

Municipal Asphalt Plant at Allegheny, Pa.

The municipal asphalt plant which has been in operation since August 3, at Allegheny, Pa., has made a saving to that city of $6,480.58. From August 3 to September 30, the city has laid 9,947.45 sq. yds. of asphalt in repair work on the streets, at a total cost of $7,445.86. Work has also been done for the plumbers, the gas companies, and the Pittsburg Railway Company to the amount of $1,754.04.

PROBLEMS OF MUNICIPAL CONTROL

Opinions on Municipal Ownership—Municipal Ownership Inquiry—Census Report on Public and Private Electric Plants—The Value of the Baltimore Fire.

Some Varieties of Opinion on Municipal Ownership.

Mayor Dunne, of Chicago, sent to the council an order directing the local transportation committee to cease negotiations with the street railway companies for a franchise. The vote taken indicated that the council favored the passage of a franchise ordinance, being 37 to 27 in favor of it, thus putting the city council on record on the question of municipal ownership.

Two opinions on municipal ownership have been recently expressed by two Americans who have been making a study of municipal ownership problems even carrying their investigations to foreign countries. One, Marshall Field, asserts that municipal ownership is a fad, as the silver question was, and will soon drop out of the public mind. He says:

I predict that within five years we in America will hear nothing more about it. After Mayor Dunne's campaign in Chicago I certainly ought to know enough about the subject to know that municipal ownership is a bad thing for us.

The other, James Reynolds, a former university settlement worker, who was secretary to Mayor Low during his term as mayor of New York City, says:

In Japan I find some fine demonstra-

tions of the benefits of municipal ownership. Take Osaka for example. The street railways, telegraph and telephone service, water and lighting plants, as well as all other public utilities, are owned by the municipality. During the time the system had been in operation the city has received returns of 30 per cent. on the investment.

Scope of Municipal Ownership Inquiry.

The commission appointed recently by the National Civic Federation to investigate public ownership and operation, met in Earl Hall, Columbia University, October 5. The commission discussed three questions, as follows:

Shall the foreign inquiry confine itself to such public utilities as gas, water, electricity, power and lighting, and street railways?

Shall it include government ownership of railways, telegraph, telephones, parcels post, postal savings banks, etc.?

Shall it further include what comes under the general head, in England, of municipal trading, such as municipal markets, abattoirs, bakeries, laundries, opera houses and tenements?

Samuel Gompers, first vice-president, who presided in the absence of President August Belmont, spoke of public ownership of street railways, saying that the subject was one of great interest to students and thinkers, and that all people, whether for or against public ownership, would welcome a fair, just and thorough investigation of the matter. He said:

Municipal ownership for street railways, however, is impracticable for organized workmen or bodies in the present state of affairs. It is inconsistent with the aims of the working people, so it is a question that must be considered at great length. It is a big proposition.

A long discussion followed as to the size of a committee. A committee ranging from nine to twenty-one members was favored by many, and all thought that the committee should start as soon as possible on its investigation, and that reports should be made as the work progressed. Alexander Revell, of Chicago, said:

I do not think that we should go into the matter from the side of the owner or the wealthy class alone, but should study all sides. It is the duty we owe to the poorer class of people to probe to the bottom any method that will be of benefit to them.

All of the speakers advocated limiting the entire investigation to the three subjects named above, and said that the scope of the investigation should include reports of railroads, public and private, bookkeeping and statistics, and that municipal organizations should be looked into. William J. Clark, of Philadelphia, president of the United Gas Improvement Co., said:

We should especially look into the bookkeeping of the companies and study them —even if figures and facts do not always agree, as we have lately discovered.

Letters were read from J. W. Jenks, Cornell University; Carroll D. Wright, of Clark College, and others, advocating the limitation at present of the investigation to street railways, gas and water.

Census Report on Electric Light and Power Stations.

The forthcoming report of the Census Office on the subject of private and municipal electric light and power stations in the United States is said to make an exhaustive comparison of the operations of these plans under private and municipal control, which results favorably to the argument of municipal ownership. The government collectors of statistics were unable to get all the facts they sought from the managers of electric light and power stations throughout the country. Enough data and figures of cost and construction and operation were obtained to form the foundation for a report of 200 pages. The report shows that the general cost of operating electric lighting stations under municipal management is considerably less than the charge imposed by private plants. The margin of difference is very great in certain states. Private companies can furnish motive power cheaper than municipalities according to this report. This is explained by the statement that the chief function of municipal electric plants is to furnish illumination and not power.

Of a total of 3,620 electric plants in this country, 2,805 are owned by private companies. The balance, 815, represents the accomplishments of municipal activities in this particular direction.

Following is an abstract of the report:

The average cost of operating plants is higher for those under private management than under municipal control. The average total expense per year for the 2,805 private stations was $22,401, as compared with $6,437 for municipal stations. The private stations gave employment on an average to 7.4 wage earners, and the municipal stations gave employment to but three.

The private stations reported a total dynamo capacity of 1,472,996 horsepower, the total cost of construction being $482,719,879. The cost of construction and equipment of municipal stations from their origin down to the closing of the government's investigation was $22,020,473, while the total dynamo capacity shown is 151,984 horsepower. This represents an average of nearly $145 per

horsepower of generating capacity as the cost of construction and equipment of the plants.

The difficulty of taking this figure as the basis for comparison is shown by the wide variation revealed by the different States in regard to those plants. In the State of Washington, for instance, the average was $844 per horsepower, while in Connecticut it was $260 and in California $210. No other State approximated these figures, although Massachusetts, with $187, and Michigan, with $175, were considerably above the average. In both New York and Pennsylvania an average of $156 a horsepower prevailed.

The average for the private plants also fluctuated. In New York, with a total cost of construction and equipment of $112,185,000, the dynamo capacity was 245,823 horsepower. This gives an average of $456 a horsepower. This average is greatly exceeded by that for the State of New Jersey, where there are no centers of population of the first class. Pennsylvania reports an average of $260 a horsepower.

A surprising feature of the investigation is the discovery that the bonds of the private companies are floated at almost as low a rate of interest as the bonds of the municipalities that have gone into the management of electric plants. Of the 815 municipal stations enumerated, 656, with an authorized funded debt of $12,625,482, reported $11,609,488 in bonds outstanding. Of these municipalities, 635 reported the payment of interest amounting to $504,805 on bonds to the value of $11,239,588, the average rate being 4.5 per cent. on all bonds paying interest.

The rate of interest on the bonds of private companies is only 4.8 per cent. As a general thing, the rate on funded debt for municipalities is understood to be lower than that which can be obtained by private companies; this has been frequently advanced as an argument for placing a plant under municipal ownership, since it is reasoned that a cheaper and more economical administration may be obtained thereby.

The figures for incandescent lighting show that the rate of income a lamp is lower in municipal stations than in private stations, this fact indicating superficially less effort to push this class of business in the municipal stations. For the purely electical municipal stations the average income a lamp was $2.20, while in the group of composite municipal stations it was $2.06 a lamp. Similar averages for the two groups of private stations were $2.45 and $2.56.

The purely electric municipal stations, with 32,998 arc lamps, had an income a lamp of $68.98. The income for a commercial arc lamp was $41.12, while that of the public arc lamp was $72.48. For commercial lamps the rates of income did not differ greatly from those obtained by private plants, although in one class the rate was much lower.

There are 380 purely electrical municipal stations, and an analysis of the income derived from them presents some interesting contrasts. The gross income of the stations during the year under consideration, 1902, was $4,147,669, of which $2,276,193 was derived from arc lighting and $1,732,325 from incandescent lighting.

These stations derived from miscellaneous business of all kinds an income of only $139,241, which is barely over 3 per cent of the gross income. On the other hand, a noteworthy reversal of conditions is implied in the statistics of the two classes of lighting. In the private stations, both purely electric and composite, the income derived from incandescent lighting was very much in excess of that from arc lighting, being almost twice as much.

The earnings from sale of current by the private stations amounted to $77,349,749, and this sum represents the earning power of the dynamo electric machinery installed. New York State, with a dynamo capacity in current stations of 245,823 horsepower, reported earnings from sale of current of $16,519,000, which gives an average annual earning a dynamo horsepower of $67.20.

The gross income from all municipal stations during 1902 was $6,956,105, of which all but $128,249 was derived from the sale of current. This gross income was earned by 815 stations, giving an annual income a station of $8,546 a year, as compared with an average of $28,070 for private stations.

What the Great Fire has Accomplished for Baltimore.

By Judge Oscar Leser, Baltimore, Md.

Following is an abstract of Judge Leser's interesting address to the League of American Municipalities:

When, on February 7th and 8th of last year, the choicest business section of Baltimore was laid in ashes, it seemed indeed for a time that the Monumental City had been given a blow from which it could never hope to recover. Seventy-three city squares, including the whole of the sixty-acre plat upon which "Baltimoretown" had been originally laid out one hundred and seventy-five years before, were covered with ruins. The buildings of nearly all the banks, trust com-

panies, insurance companies, newspapers and prominent mercantile and manufacturing establishments were down. In the very heart of the city, out of about 1,400 structures in the path of the flames, only a score were spared. By good fortune the city hall, court house and postoffice buildings were comparatively unharmed. The direct property damage is estimated at from fifty to seventy millions of dollars. Probably 30,000 persons were thrown out of employment—all without the slightest forewarning.

My chief aim is to present, in collated form, some of the more prominent beneficial effects which are directly traceable to the new conditions created by the fire.

To be placed first in this category is the exhibition of the spirit of self-help which was manifested by the citizens, led by our then mayor, the late Robert M. McLane. Though the legislature shortly afterwards appropriated $250,000 "to relieve cases of destitution and need," less than one-tenth of that sum was drawn for that purpose. In exactly six months the relief work was concluded.

A comprehensive program was at once mapped out on the initiative of Mayor McLane, not only to carry on with renewed vigor the projects for a sewerage system, increased parking and development of the suburban sections—all of which were in the throes of agitation at the time of the fire—but to strike out boldly for other improvements, which, but for the fire, would scarcely have been dreamed of.

Of the several propositions which emanated from the emergency committees, two were of pre-eminent importance—the construction of municipal docks along a part of the water front in the burnt district and the widening and extension of certain streets. Both plans involved the acquisition of much private property. To make this at all feasible, it was essential that the legal machinery for the accomplishment of the plans be set in motion before rebuilding should begin. Legislative action was required, not only to provide for the peculiar necessities of the problems, but also in the case of the docks to authorize the creation of a loan, which in turn had to be submitted to a referendum. It was fortunate that at this particular time the city's net debt should be at the lowest point it had reached in nearly twenty years, due to the receipt of over $8,000,000 two years before from the sale of the Western Maryland railroad. Over one-half of this fund was available in cash, and proved to be sufficient to pay for the street widenings, which within ten weeks of the fire, though not without a violent struggle, were—with only one important exception—finally approved by the city council.

At a special election held on May 17, 1904, the people ratified the $6,000,000 loan for the docks. Eighty per cent. of the votes cast were in favor of the proposition, indicating a commendable perception of the best way to finance a city out of a calamity. The rentals will be sufficient to meet interest and sinking fund charges on the loan.

It is hardly necessary to dilate upon the tremendous advantages which such a dock system, under centralized control, will have over former conditions when several hundred separate owners of this water frontage managed their antiquated properties without effective cooperation. The further addition of 220,000 square feet to the area of the two streets which border on the "Basin" or inner harbor will promote the shipping interests, just as the widening of West street did in New York, and Delaware avenue did in Philadelphia.

The mere ratification of the dock loan proved to be a valuable asset to the city before the rivers and harbors committee of congress. Baltimore was assured of a handsome appropriation under the formula that congress helps those who help themselves. Thus we should add a deepened channel to the good things we owe to the fire.

Ten streets have been widened, giving an increased traffic surface of eight acres; two streets have been extended beyond their former termini; a large plaza will hereafter protect and beautify the western front of the court house; numerous changes in the grades of streets have been made.

In the very heart of what was once the worst slum district, the city will erect large wholesale fish, produce and fruit markets at a cost of about a half million dollars, in close proximity to the new docks.

The commission was given plenary powers in the purchase and condemnation of property. Altogether $10,600,000 was placed at its disposal in the conduct of the various public improvement plans already described. The expedient was a novel one, but has given eminent satisfaction. The act of assembly is not copyrighted, so that the general scheme of the commission can be commended without reserve to any city which has a similar chance to make the most of a disaster.

It will be instructive to note the various ways in which the fire has affected the interests and affairs of the city, in and out of the fire zone. In nearly every instance, that effect has been beneficial.

Baltimore is to have a new building law. A commission of experts has nearly completed the task of devising a system of rules and regulations which will not only minimize the danger of future fires but will stimulate the erection of better classes of buildings.

The pernicious system of irredeemable ground rents, which has been responsible for retarding enterprise, has received a severe blow. The creation of such rents was forbidden over twenty years ago, but legislation could not reach such as were then in existence because, as contracts, they were inviolate. The acquisition of the land for streets, plazas and docks wiped out several hundred of these rents. The rebuilding in other sections of the burnt district and in the adjacent territory brought about many voluntary sales of ground rents to the owners of the leasehold, thus merging them and putting them out of existence.

Strange as it may seem, land in the burnt district increased perceptibly in value almost immediately after the fire. The sudden opening of opportunities for development upon modern lines by the enlargement of building sites and the erection of structures adapted to modern needs; the high civic spirit displayed after the fire; the prospect of a municipal dock system; widened, regraded and better paved streets; all portended enlarged prosperity. In spite of the fact that about one-eighth of the private property in the burnt district was absorbed for public purposes, the taxable basis in that portion of the city, considering the ground alone, has been raised by about $6,000,000. In many cases lots covered with debris were sold for more than they would have brought before the fire, with the buildings on them.

The extent of the resourcefulness and recuperative ingenuity of the city authorities may be measured by the fact that the tax rate for the next year was only 5 cents higher than that of the year before.

The fire had a notable influence on public opinion with respect to one great improvement which had been a desideratum for many years. I refer to a general underground sewerage system. There was a time when we were ashamed to admit that of all the large cities of the country, Baltimore alone was without this sanitary requisite. Things will soon be different.

A great movement to secure this civic blessing had been inaugurated by Mayor McLane in the fall of 1903, to provide improvement of the "Annex"—a large suburban portion of the city—and one sewerage loan, which was the largest and million for additional parks. In the midst of all came the great fire. Without extending the narrative, I am proud to say that at the spring election of this year these several loans were ratified, the ten millions for sewers; two millions for against which the greatest opposition had been waged, receiving the greatest majority, though it was the only one which might increase the tax rate.

Thus far $23,600,000 have been spent or authorized to be expended. The contemplated new loans will make a total of about $35,000,000 to be put into circulation toward public betterments after the fire. If we add to this the enormous amount of private capital which is flowing in a steady stream into the burnt district, to replace the destroyed buildings, machinery and merchandise, the aggregate swells to over a hundred millions. The distribution of money on such a tremendous scale is naturally awakening activity in countless ways.

Many of those who came to the city for temporary employment have made it their permanent abode. Outside capital, attracted by the great opportunities of the new situation, has become inside capital. And in this connection it is a pleasure to record that the embargo of the former mortgage tax was promptly lifted by the legislature. The new law virtually left the imposition of such a tax optional with each county. Thus the great fire put to an end an economic blunder which never had any basis but unthinking prejudice against the capitalist.

The wholesale condemnation of private property disclosed defects in the organic law. This has provoked agitation for a change in the constitution and may have weight in determining whether there shall be a constitutional convention, when the people vote on this question next year.

It has at last been shown in Baltimore that in condemnation cases juries can be fair to both sides.

The fire was the means of arousing the attention of Andrew Carnegie and John D. Rockefeller to the worthiness of two of our great institutions, the Maryland Institute and the Johns Hopkins Hospital.

We owe to the fire the enactment of a drastic law (the Semmes law), forbidding encroachments beyond the building line. Although by a decision of the courts its application has been restricted to the burnt district, the law has been of the greatest benefit.

The discussion which followed the enforcement of the Semmes law has had the wholesome effect of making the peo-

ple more alert on the subject of their common rights in the highways. This was illustrated by the determined and successful opposition against the laying of steam railroad tracks on certain streets in the burnt district and by the demand that the street railway company should remove one track from an important, though narrow, street, which had two tracks. In fact, public sentiment has drawn the lines tightly against the grant of any new privileges for double tracks when the purpose can be accomplished by single tracks on parallel streets.

The real estate situation has been wonderfully improved. Where, before, transactions were comparatively few, the demand spasmodic and prices irregular, the condition now is totally different. At one stroke thousands of leases were forcibly terminated. These leases had been made at different prices on various dates for varying terms of years, on buildings that were so unlike in design and condition that comparison was often impossible. It was small wonder that rental values should have lacked stability and uniformity and that selling values should have been affected in the same way. All this has changed for the better. Many of the larger property holders are fixing their rentals on a scientific basis, that of a certain percentage of the value of the ground and another percentage (usually a little higher) on the building.

The activity in real estate dealings was not confined to the burnt district. All over the city conditions have improved. It is estimated that there has been an average advance of at least 20 per cent. in the value of the city's real estate since the fire.

The engineering difficulties in rehabilitating the city were many. Co-operation among the several independent heads of departments having to do with problems of this character became a necessity. Accordingly the city engineer, electrical engineer, water engineer, topographical engineer and other heads have voluntarily formed a board of engineers, whose purpose is to promote harmony of action and economy of effort and expenditure. Out of the deliberations of these experts have come many excellent suggestions for reform in administrative methods and municipal machinery. It is probable that within a year we shall have a board of surveys with plenary power to fix street grades and lines, building lines and lot boundaries, and to survey and keep dimension records of city real estate of all kinds. Provision is also to be made for an official platting of all private titles and for a compulsory registration with the bureau of real estate transfers, the great utility of which must be manifest to all practical administrators of municipal affairs.

The fire came at an opportune time to save the principle of a separate municipal election day. Both of the leading party organizations had advocated a return to the old system. The bill passed both houses, but was vetoed by Governor Warfield solely on the ground that the linking of municipal with state and national issues would embarrass the people in the settlement of the great problems before them. These problems, it may be remarked, were also the inducement which led to the formation of a municipal league, an organization which started out auspiciously and gives every indication of becoming useful to the community.

Baltimore has already made tremendous strides in every direction since the terrible visitation in February, 1904. That event has proved to be a point of departure from the conservative and easy going style to the progressive and "hustling." The people have gained in broadmindedness. They have become used to big things. Business has increased. The attention of the world has been attracted by the wonderful pluck, energy and self-reliance of the people in the face of adversity. Still, I would not advise other cities to try this method of advertisement. It might be considered inflammatory advice.

MUNICIPAL AND TECHNICAL LITERATURE

Municipal Reports.

Municipal Reports.

Annual Report of the City Engineer of Newton, Mass. Irving T. Farnham, City Engineer.

Most of the work of the year has been routine work, requiring from 13 to 15 assistants and costing $17,748 for engineering. The city boundary has been examined, a cement testing laboratory has been established and some sidewalks and storm water drains have been constructed. The plans for eliminating grade crossings have not yet been applied, on account of the delay of the railroad companies. Five miles of underground electric conduits were constructed by the telephone company, making 22 miles in all. A small park has been improved in cooperation with the Metropolitan Park commissioners. Three miles of sewers were built, including a crossing below the Sudbury aqueduct, which required tunneling under pneumatic pressure. Plans for combining the Newton system with the Metropolitan sewerage system by gravity flow are under consideration. Part of the sewage of Newton is at present pumped up forty feet into the Metropolitan high-level sewer, which was recently completed. Authority has been granted by the legislature for increasing the water supply of Newton to 5,000,000 gallons a day. It will be seen, therefore, that there is some work ahead for the city engineer's office, when these projects are all in process of design and construction.

Annual Report of the City Engineer of Hamilton, Can., 1904. E. G. Barrow, City Engineer and Manager of Water Works.

The completion of the James street reservoir was the important feature of the year. It is of reinforced concrete, with an embankment 60 feet wide around the north end. The depth of water is 13 feet, and the capacity is 2,000,000 gallons. It is a service reservoir, permitting the constant operation of two pumps without the addition of a third pump in the heavy hours, as heretofore. The saving in cost of pumping for the year is computed as $2,760. The per capita consumption of water in 1904 was 90.8 gallons, for a population of 57,548, as compared with 103.6 gallons in 1903. The reduction is attributed to more care in inspection for leaks, metering of large consumers and less street sprinkling.

The board of works improved 5.5 miles of street with broken stone, slag and gravel and by grading. About 18.5 miles of cement sidewalk were laid. Vitrified pipe sewers were laid 3.4 miles in length. There are two plants for the disposal of the sewage of the city, which together cost $16,806 to operate.

The resurfacing of all the tar macadam streets, laid in 1899 and 1900, except one, is recommended, at an estimated cost of 30 cents a square yard, or $12,920. The one exception should have a more durable pavement, according to the report of the assistant engineer. The city engineer bids for the construction of sewers by day labor, and the city was the low bidder on most of the sewer contracts of the year. As compared with the estimates the cost varied in 25 contracts from a saving of 52 cents a linear foot as one extreme, to a loss of 63 cents as the other extreme. The cost of 10 sewers let by contract also varied from a saving of 72 cents a linear foot to a loss of 85 cents.

Cement manholes were introduced during the year and cost $29.30 each, as compared with $46.23 for brick manholes.

The city waters the streets, 61.5 miles costing $9,126 for the season, the average number of carts in use being 22 and the number of hours they were in use, 18,048.

Thirty-second Annual Report of the Lowell (Mass.) Water Board, 1904. Geo. Bowers, City Engineer.

The report of Pres. R. J. Crowley, of the board, shows a gradual increase in the number of meters in use, and that the debt of the department was reduced $21,600, leaving the amount outstanding $1,183,900. The private fire services were inspected carefully and kept sealed, except in emergencies, that there might be no unauthorized use of water. Tests of meters for use on private fire services were made with satisfactory results. The financial statement shows total receipts of $223,869, and expenditures of $181,298, the former a slight increase and the latter $19,000 decrease from the year

before. The expenditures include $45,631 interest, $21,600 paid on indebtedness and $14,000 for construction.

Supt. R. J. Thomas reports the extensions and repairs made during the year and the general operations of the system.

The city engineer reports the consumption, the cost of low service pumpage, $19.69 a million gallons and of high service pumpage, $11.52 additional, decreases of about 20 and 30 per cent. respectively from the previous year. The average head of the low service pumps is about 164 feet and of the high service pump is 82.6 feet. The cost of pumping a million gallons 100 feet high varied in the various pumps, from $5.64 to $6.68 for the low service pumps and $13.93 for the high service pump.

The report is made in the standard form.

General Information About the Department of Street Cleaning, New York City. John M. Woodbury, Commissioner.

This is a fully illustrated pamphlet prepared by Fred L. Stearns, a former employe of the department, which describes the methods of street cleaning, collection and disposition of refuse and snow removal, the stables, dumps and scows belonging to the department, the use of the refuse incinerator, and so forth, all fully illustrated with photographs. The volume was prepared for the Municipal Museum at Chicago, which has a most valuable collection of material upon municipal matters in its possession and also has frequent loan exhibitions of apparatus, materials and data.

ORGANIZATIONS AND INDIVIDUALS

National Association of Cement Users—Italian International Exposition—The Baldwin Prize—Technical Meetings—Personal Notes.

The National Association of Cement Users.

The Board of Directors of the National Association of Cement Users held two important meetings in April and September, in the first of which, in addition to the routine business of the Association, the Board arranged for its representation on the advisory board of the experiments on structural materials in progress in St. Louis, Mr. Richard L. Humphrey, the president, being the representative appointed. Mr. Humphrey is the secretary of the advisory board. At a meeting of societies and representatives of departments specially interested in tests of the fire-proof qualities of concrete, Mr. Humphrey was made chairman of the committee formed to consider and advise regarding these experiments.

At the September meeting plans were made for the convention to be held in Milwaukee, Wis., Jan. 9 to 12, 1906. A. Moensted, fourth vice-president of the association is the local representative of the board at Milwaukee, and will give any desired information.

The sessions of the convention will be held in a commodious hall in the Armory building, which is located in the center of the hotel district. The exhibit of materials and appliances will be held in the drill room of the Armory, which is a large, well-ventilated and well-lighted room. Should the exhibit space required be greater than was used at the last convention there are several adjoining rooms and halls in the same building into which it can overflow. The room is on the ground floor and heavy machinery can be unloaded directly upon the exhibitor's space. A number of applications for space have already been received and others should be made to the secretary, Charles Carroll Brown, at the association's headquarters, 310 Commercial Club Building, Indianapolis, Ind.

But little can yet be said about the program for the convention, but that little is very encouraging. The committees having charge of the program are at work and promise good papers and opportunity for full discussion. The following papers have been definitely promised:

"Air Tamping of Concrete Blocks and Conveying of Blocks," by J. P. Sherer, Milwaukee, Wis.

"Observations on the Testing and Use of Portland and Natural Cements," by E. S. Larned, C. E., Boston, Mass.

"Building Regulations Regarding Concrete Blocks," by Will J. Scoutt, Chicago, Ill.

"Concrete as a Fire-proof Material," in some of its special phases, by E. T. Cairns, chairman Committee on Cement for Building Construction of National Fire Protection Association, Chicago, Ill.

"The Use of Cement and Concrete for Farm Purposes," by S. M. Woodward of the section of irrigation and drainage investigations, office of experiment station, U. S. Department of Agriculture, Washington, D. C.

"Waterproofing," by J. L. Mothershead, Jr., Indianapolis, Ind.

"Causes of Failures in the Concrete Block Business," O. U. Miraele, Minneapolis, Minn.

"Reinforced Concrete," in one or more of its branches, by C. A. P. Turner, M. Am. Soc. C. E., Minneapolis, Minn.

The experiments at St. Louis will be described by President R. L. Humphrey, and a number of other papers have been provisionally promised and will be announced later.

The usual convention rates will be granted by the railroads. Milwaukee is noted as a hospitable convention city, with many good hotels at reasonable rates. The convention promises to exceed in interest and in attendance the very successful convention held at Indianapolis last January. Further information, membership blanks, copies of the proceedings of the last convention, can be obtained of the secretary, Charles Carroll Brown, 310 Commercial Club Building, Indianapolis, Ind.

The International Exposition, Milan, Italy.

In order to appropriately celebrate the completion of the Simplon Tunnel—one of the greatest known triumphs of engineering—an international exposition will be held in Milan from May to November, 1906. It will be the largest European exposition ever held outside of Paris. Practically all of the European countries will participate officially, as well as several Asiatic countries.

The dominant feature will be motion. All products, as far as possible, must be shown in connection with the processes, thus filling the halls with live exhibits. Arrangements will be made for field tests and competitive trials in all classes where it is expedient.

An essential feature will be the automobile display to which an entire pavilion will be devoted. This "show" will terminate in mid-summer, so that machines exhibited may be sold for early delivery.

The marvelous industrial and economic development of the kingdom during the past decade has made Italy the best European market for those products that the United States can well supply.

This prosperity places at the disposal of the people the means to purchase amusements as well as the necessities of life. Consequently a large attendance at the exposition is confidently expected.

The great success that attended the Turin Exhibition of Decorations has prompted the Milan authorities to set aside a special pavilion for decorative arts. They are very desirous to see the United States well represented in the section.

One large building will contain all forms of welfare work, grouped under the several heads: Mutual assistance and insurance, co-operation, savings institutions and popular credit, protection of labor and insurance against enforced idleness.

J. H. Gore, Geo. Washington Univ., Washington, D. C., may be addressed for further information.

The William H. Baldwin Prize.

The National Municipal League has established the annual William H. Baldwin prize of $100 to the author of the best essay on a subject connected with municipal government. For 1905-6 the competition will be limited to students in colleges having distinct instruction in municipal government. The subject is "Franchise Grants to Gas and Electric Light Companies." Those entering the competition are expected to treat the following subdivisions of the question:

1. The relative powers of State and municipal authorities in the granting of gas and electric light franchises and in determining the conditions of such grants.

2. The terms of franchise grants to gas and electric-light companies with special reference to conditions existing in a large American city.

3. Efficiency and cost of service to the consumer.

4. The reserve power of the State and municipal authorities over the efficiency and cost of service to the consumer.

It will add to the value of the papers

submitted if the question of the elements of the cost to the company of the service to the consumer, and the relation between actual cost to the company of rendering the service and the charge to the consumer for the same, be considered.

Papers submitted by competitors must not exceed 10,000 words in length. Clinton Rogers Woodruff is secretary of the National Municipal League, North American Building, Philadelphia.

Technical Meetings.

The annual convention of the National Association of Manufacturers of Sand-Lime Products will be held at the Hotel Cadillac, Detroit, Mich., Dec. 5, 6 and 7. The program includes the following papers: "The Scientists' Message to the Sandstone Brick Makers,' "The Characteristics of a Good Sand and Its Proper Preparation," "Lime and Its Relations to Sand-Lime Products," "Best Method of Hydrating Lime and Grinding Lime," "Coloring Matter for Sandstone Brick," "Coloring Brick," "The Rotary Press," "The Vertical Press," "Liners," "The Kent Mill," "The Tube Mill," "The Dry Pan," "Dryers," "Hardening Cylinders," "Sand-Lime Blocks and Appliances for Same," "Standardizing Sandstone Brick," "Sandstone Brick from the Contractor's Standpoint," "Marketing Brick," "It Pays to Advertise," "Insurance; How to Construct and Handle a Plant so as to Secure the Lowest Rate of Insurance," "Publicity in Showing the Advantages of Sandstone Brick," "Management," "Cost of Sandstone Brick," "Measuring Devices," "Approved Methods of Manufacturing Sandstone Brick." H. O. Duerr, secretary, Wilmington, Del.

The eighth annual convention of the League of California Municipalities will be held at Chico, November 15, 16 and 17.

The annual convention of the American Gas Lighting Association was held in Milwaukee, Wis., October 18, 19 and 20. About 40 delegates, representing many millions of dollars' worth of property, were present. President E. G. Cowdery, of St. Louis, Mo., in his annual address favored publicity for all large organizations and a national commission for framing a uniform taxation bill governing gas and telephone companies, such bill to be presented to the various state legislatures. He also recommended a national fund for the investigation of the municipal ownership problem, saying that he thought the more the public looked into the subject the less it would favor it. The association voted to accept the report of the special committee recommending the consolidation of the American Gas Lighting Association with the Ohio and Western Associations. The report was accepted unanimously and the council was authorized to negotiate for a consolidation. New York City was chosen for the next convention. Charles V. Pritchard, of Lynn, Mass., was elected president; vice-presidents: Charles R. Saben, Jr., Toledo, O.; Alfred E. Forstall, New York City; Arthur G. Glasgo, London, England; secretary and treasurer, George G. Ramsdell, New York City.

The annual meeting of the American Society of Mechanical Engineers will be held in New York City December 5, 6, 7 and 8. F. R. Hutton, secretary, 12 W. 31st St., New York City.

At a meeting of the Western Society of Engineers, October 4, Dwight H. Perkins read a paper on "A Metropolitan Park System for Chicago," in which he described the proposed system of outlying parks in the valleys of the Desplaines, Chicago and Calumet rivers, and the small parks and public playgrounds to improve conditions in the poorer and densely populated sections of the city. H. G. Foreman, chairman of the special park committee, J. F. Foster, superintendent of the South Park Commission, and R. H. Warder, superintendent of Lincoln Park, made addresses on the same subject.

The Indiana Municipal League will hold its next convention at the Commercial Club, at Indianapolis, November 15 and 16. John F. Taggart, city clerk of Richmond, is secretary.

The Ohio Valley Improvement Association will hold its next meeting at Cairo, Ill., November 15, 16 and 17. Its object is to secure 9 feet depth for navigation in the Ohio river from Pittsburg to Cairo.

Personal Notes.

W. P. Cain has resigned as city engineer at Leadville, Colo.

Hon. W. L. Frierson was elected mayor at Chattanooga, Tenn., October 10.

Henry Litchfield West was reappointed Commissioner of the District of Columbia, for a second term, October 13, by President Roosevelt.

Hon. Augustus S. Miller, mayor of Providence, R. I., died suddenly of heart disease recently, aged 58 years.

George W. Lamson has been appointed representative of the California Asphaltum Sales Agency, with headquarters at 753 Railway Exchange building, Chicago, Ill.

John J. Pallas, president of the park board and park commissioner for the boroughs of Manhattan and Richmond, New York City, died suddenly of an acute attack of cardiac dilation, October 16.

Holmes Hollister has resigned his position as superintendent of the water department, at Ithaca, N. Y., on account of ill health, but will serve as a commissioner. He is succeeded as superintendent by Frank L. Getman.

Henry J. Hopper, ex-mayor of Jersey City, N. J., died at his home in East Orange, N. J., October 5.

S. M. White has been appointed city engineer at Superior, Wis., succeeding Howard Thomas, who resigned to devote his time to private practice.

Frank L. Fales, Assoc. Am. Soc. C. E., died October 5, at Denver, Colo., where he had gone for his health, aged 40 years. Mr. Fales was a prominent civil and sanitary engineer, and previous to going to Denver last spring was assistant in the office of the chief engineer of the commissioners of water works at Cincinnati.

C. W. Meacham has severed his connection with the Crosby Steam Gage & Valve Co., to become president of the Alan H. Tripp Co., 118-120 Michigan St., Chicago.

Henry R. Buck, Jun. Am. Soc. C. E., assistant city engineer at Hartford, Conn., has been appointed chief engineer of the Connecticut Boundary Commission, which will co-operate with a similar commission from Massachusetts in a resurvey of the boundary line between the two states.

H. H. Rice, secretary of the American Hydraulic Stone Company, Denver, Colo., received the first prize in the recent competition for the best paper on "The Manufacture of Concrete Blocks and Their Use in Building Construction." The second prize was awarded to Wm. M. Torrance, C. E., assistant engineer in charge of concrete-steel design for the Hudson Tunnel Companies of New York City.

MACHINERY AND TRADE

Machine for Making Steel-Concrete Fence Posts.

The Indestructible Post Company, realizing that on account of the heavy freight charges they are unable to ship to any considerable distance their posts complete with base, are offering to the trade in connection with their business of manufacturing and sale of the posts and hollow block machinery an outfit for the manufacture of indestructible posts. These posts are shown in a cut in their advertisement on another page.

The machine consists of a mold with hinged sides and end. The front gate of the machine or head block is an iron casting with an angle shaped opening through which the operator inserts the punched angle which is to form the fence post. The lower portion of the head block is cut away sufficiently to admit of the insertion of what the manufacturer terms a pallet, which consists of a cast iron plate having the dimensions of the side of the concrete portion of the post. At one end of the pallet is an angle bar saddle which extends out beyond the machine. When the pallet is inserted in the machine the rear end gate and sides are closed and the head block is inserted and concrete is tamped into place by hand in the bed of the machine up to about one half thickness of the base. The punched steel angle which is to form the body or upright of the post is inserted through the perforation in the head block, the saddle on the end of pallet in connection with the angle opening holding it in alignment. More concrete is then dumped into the machine and tamping continued until the machine is full. To remove the finished post the catches are released allowing end and sides to drop down, which permits the operator to lift out the completed post on the pallet. The pallet and post are then laid aside where the post is permitted to dry for several hours before removing it from the pallet.

The outfit for making these posts consists of one machine, fifty pallets and tamper. The post proper is a punched angle made of high carbon stiff steel of a sufficient length to give 52, 60 or 66 inches above the base or ground level. These angles are 1¼ by 1¼ by 5-32 inch or 1-12 by 1½ by 3-16 inch, punched suitable for any kind of fencing. The machine makes the base 30 inches long tapering from 4 by 4 inches at the ground level to 4 by 5 inches at the bottom. The manufacturers of this outfit have made arrangements with one of the largest steel companies whereby the steel uprights used in the manufacture of indestructible posts can be sold at a very low price to parties purchasing these post making outfits.

Claim is made by the company that in almost every part of the country these steel-concrete posts can be manufactured by means of this outfit at a very low cost and at some points at a less cost than good cedar posts.

Indestructible posts will practically last

forever and they will not need repairing or replacing every few years like wood and other manufactured posts.

The capacity of this outfit is 50 posts per day. The capacity of the machine proper is 200 posts per day, but in order to make this number of posts it would be necessary to purchase additional cast iron pallets, which can be obtained at a very reasonable cost. The price of the outfit is $75.00.

Full information regarding this successful outfit will be furnished by the Indestructible Post Co., First National Bank Building, Chicago, Ill.

The Blair Automatic Lamp.

A sectional view of the Blair automatic lamp, model C, is given to show the new and ingenious features in this successful gasoline lamp.

The gasoline is poured into the tank, A, through the opening covered by the fill cap, T. Its rate of flow into the generating coil, B, when the lamp is in operation, is regulated by a valve operated by the regulating screw, C, which is set for the rate of flow necessary to give the candlepower of light desired. The diaphragm forming part of the mechanism of the valve is marked D, and the seat of the valve is marked S. It will be seen from the position of tank and pipes that, when C is open, the gasoline will stand at the same level in tank and pipes and will not overflow. Heat enough to begin the generation of gas is furnished to start the lamp by lighting a little alcohol, which is poured into the cup, K, through the trough, L. When this heat has generated sufficient gas, a light pressure is developed in the tank and generating coil, which carries the gas through the cross-fire tube, O, and nozzle or injector, E, across an open space, where the rapidly moving jet of gas draws in the necessary supply of air for perfect combustion of the gas. This mixture of gas and air enters the guide tubes, F, and passes to the burner cap, G, and the alcohol flame in K ignites it. The burning gas heats the mantle, H, to incandescence and the products of combustion pass up through the lamp and the supporting tube and out of the ventilator, W. I is a binding screw to hold the support for the mantle. J is the globe surrounding the burner, offering no obstruction to the light downward or sideways, thus obviating the casting of shadows by any part of the lamp. R is a reflector to further concentrate the light in the lower hemisphere. X is the metal dome enclosing the mechanism of the lamp, which is raised into the dotted position while cleaning and lighting the lamp. The generating coil is carried over into the top of the gasoline tank by the tube U.

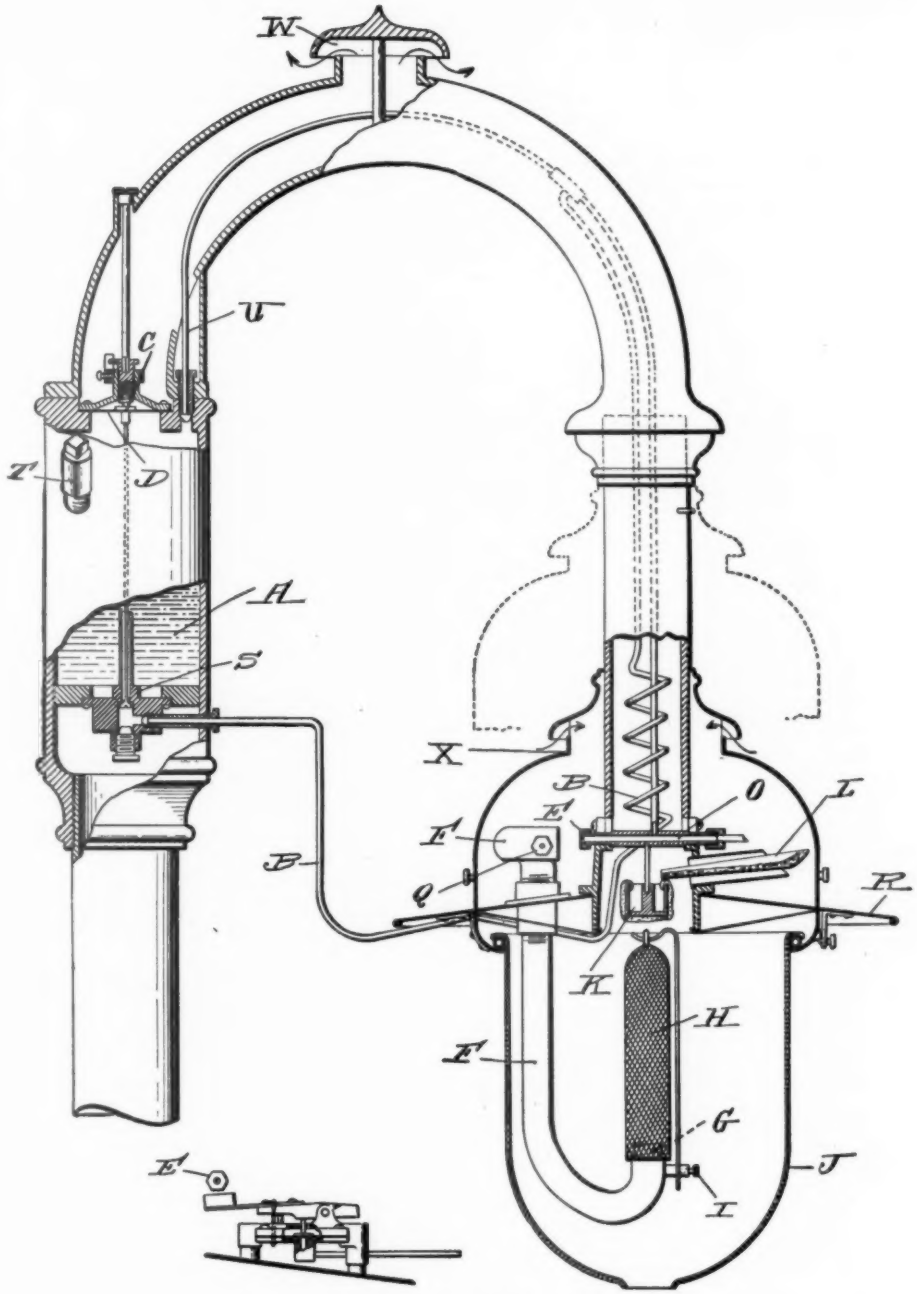
At the bottom of the cut is shown an ingenious automatic arrangement for putting out the light in case it should get too hot. E in this small drawing is the end view of the nozzle or injector, E, of the large drawing. Below E is seen a small metal plate which is attached to a lever held in place by a wire. The other end of this lever is subject to the same gas pressure as the lamp. The wire is of such strength that when the lamp approaches too great temperature, the pressure of gas generated by the heat breaks the wire and the metal plate moves up in front of the nozzle E, and shuts off the flow of gas through the burner, thus putting out the lamp.

This is the latest design of a lamp which has been in successful use for several years. It removes the oil tank from its usual position over the burner and adds the safety feature just described, which is seldom, if ever, required to act in actual practice. Full descriptions of the light will be supplied by the Blair Light Company, Northboro, Mass.

Creosoted Wood Block Pavement.

A newcomer in the field of creosoted wood block pavements is the Kettle River Quarries Company, of Minneapolis, Minn. This company has long been favorably known in the Northwest for the supply of excellent material for stone block pavements, the Kettle River sandstone having some qualities which make it a more satisfactory paving than granite. There are many streets of this material in the cities of the Northwest within reach of a reasonable freight rate.

Recognizing the demand for a smoother and less noisy pavement for the residence districts and for other streets of light traffic, the company has erected a creosoting plant and is now prepared to supply creosoted wooden paving blocks upon demand. A handsomely illustrated booklet has been issued by the company, giving the many good points of wooden block pavements, which have often been stated in MUNICIPAL ENGINEERING. Under the weather conditions of the cities of the Northwest some of the points of advantage are specially emphasized; for example, the great changes in temperature affect the creosoted wooden blocks less than any other smooth surfaced pavement. Freight rates are less on wooden blocks than on brick or stone, and a greater area can be covered from a given



SECTION OF BLAIR AUTOMATIC LIGHT.

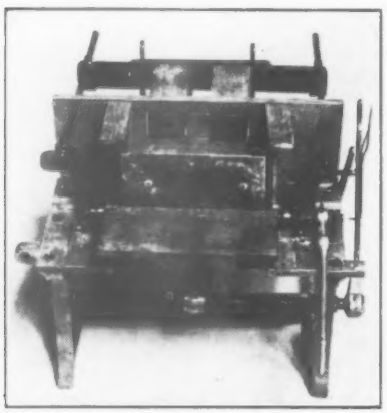
center. The supplies of timber are still ample in this region, making low first cost of material.

The two materials, sandstone and creosoted wooden blocks, seem to be the most favored by nature in the State of the Northwest, and with both on their list this company is able to supply all demands.

The handsomely illustrated booklets regarding the two paving materials, and also the use of the sandstone for high class buildings, will be sent to inquirers on appdication to the Kettle River Quarries Company, Minneapolis, Minn.

The Reed Cement Block Machines.

The Wichita Coal and Material Co., Wichita, Kan., is putting on the market a



THE REED FACE-DOWN HOLLOW CONCRETE BLOCK MACHINE.

line of machines for making cement block and brick, called the Reed cement machines.

One of these, a photograph of which accompanies this article, is a down face machine. The cut shows the machine after a manufactured block has been taken out. The pallet in front is ready to place in the mold box for the next block, the rock face plate is standing erect back of the pallet and in front of the mold box and the cores are drawn back out of the mold box. One motion of the plate lever will turn the face plate down into the mold box and raise the pallet, which may be of wood or cast iron, up against the end plates, to form one side of the mold box. The face mixture of say 1 part cement to 2 parts of sand, colored if desired, will then be shoveled in for a thin layer and the backing of a 1 to 4 or 1 to 5 mixture will be shoveled in on top. This is tamped up to the level of the cores, which are thrown into their position in the box by one motion of the core lever. The box is then filled up and tamped and the top smoothed off. A reverse movement of the core lever withdraws the cores and one of the plate lever tips the block up so that it rests on the pallet and is ready for removal. It is said that 350 blocks a day can be made on this machine The 8-inch machine makes blocks 8 inches high, 6, 8 or 10 inches thick and 18 or 24 inches long The face plates may be either plain or rock face of any desired design. The dimensions of the blocks measure even inches including mortar joint when laid in the wall.

A side face machine is also made, the special feature being the elevation of the completed block out of the machine ready for removal by one movement of a lever. This machine is said to have a capacity of 600 blocks a day. There is an ingenious device for removing the blocks from the machine when a rock face or other face not wholly plane is used.

There is also a Reed brick machine which makes standard 2 1-2 by 4 by 8 cement bricks ten at a time, the partition plates being moved into place in the mold box and out again by one motion of a lever and its reverse and the bricks being raised out of the box in position to carry away by one motion of another lever. The capacity claimed for this machine is 6,000 common building brick a day. Fancy bricks requiring trowel finish or colored face require more time.

The Wichita Coal and Material Company, Wichita, Kan., are large dealers in builders' supplies and have developed these machines and the factory conveniences desirable for their economical and easy operation to meet the demands of their trade. They will send circulars and full information on request.

A Gutter Cleaner.

J. H. Strain, 254 East 21st Street, Brooklyn, N. Y., has a gutter cleaning machine which cleans paved gutters where sand and mud have accumulated from unpaved adjoining streets. For snow, the beam breaks down the ridge so that teams can approach the curb. It will work in any depth of snow that horses can travel through. This machine being operated by the foot, leaves the driver's hands free to handle his horses. Used after each snow storm, gutters can be kept free from snow

and ice and allow the unobstructed flow of water to the catch basins. Cleveland, Ohio; Bayonne, N. J. and Bridgeport, Conn. have them in use.

Prizes to the Cement Machinery Company.

The Cement Machinery Company, which manufactures the Normandin, Peninsular and Cemaco block machines, also the Universal fence-post machines and Systematic mixer, have received information from the president of the Lewis and Clark Exposition, at Portland, Ore., that

CEMENT MACHINERY CO. JACKSON MICH.
NORMANDIN BLOCK MACHINES
OUR MACHINES
ADOPTED TWICE BY THE UNITED STATES GOVERNMENT.

NORMANDIN EXHIBIT AT PORTLAND FAIR.

the exhibit of their machinery, as well as the product therefrom, has received the highest award, a gold medal, for superior excellence. The above-named company carried away the highest honors at the Universal Exposition, St. Louis, 1904.

Their blocks are used in the first concrete-block house built on Staten Island, in the city of New York, and the first the building department has permitted.

The Monarch Road Roller Company.

Mr. J. B. Tuck purchased at the Trustee's sale, Sept. 14, 1905, all the property of the American Road Roller Company, which includes about twelve acres of real estate in the town of Groton, N. Y., on which is located a modern, up-to-date plant, including boiler shop, forge shop, foundry, machine shop, power house, stock room, paint shop, wood shop, and warehouse, which gives 100,000 sq. ft. floor space. The power house is equipped with two 150 H. P. boilers, American Ball compound engine with direct connected generator, all the machinery in the plant being operated by electricity. The foundry has two cupolas, the boiler shop is equipped with pneumatic boiler making machinery, and the machine shop with the best machines now used for its class of work, including a full line of boring mills, planers, lathes, milling machines, drills, shapers, etc., and each shop has electric travelling cranes.

The plant was originally erected about four years ago by the Conger Manufacturing Company but has been largely added to and new machines installed by the American Road Roller Company within the past two years.

Mr. Tuck's purchase includes, besides the real estate, plant, machinery and tools, a very large stock of raw material and goods in process of manufacture.

Mr. Tuck has just incorporated under the laws of the State of New York the Monarch Road Roller Company with a capital of $250,000, intending to put the

plant in active operation within the next thirty days, and will manufacture road rollers, traction engines, street sweepers, etc.

The New H. S. Palmer Concrete Block Machine.

Mr. Harmon S. Palmer put on the market the first practicable and successful hollow concrete block machine and has probably had more years of experience with block and machine construction than any other man in the country. As the result of his study and experience he has devised a new machine, which is intended to meet as nearly as possible all of the objections which have been made to hollow block machines by those who desire the very best results in quality and appearance of blocks. Some of the points of excellence are named here. The adjustable hopper, which acts as a float and trowel in striking off the top of a block is the first convenience met in operating the machine. The sides and corners of the mold box are rigid and held rigidly in place, and any wear is taken up by set screws. Wedge shaped slots prevent spreading of any sliding pieces. The cores are tapering. The sides of the machine are set at exact distances apart by means of figured scales on each end of the frame. The end doors need not be changed for differences in width as the side doors abut against their inner surfaces whatever the setting for width. A large coiled spring around the main shaft of the machine automatically closes the machine after a completed block has been removed, thus performing this operation without manual labor and leaving for the operator only to place the closing or locking bars. The provisions for division of blocks and for changes in cores have been improved in the new machine.

The compactness of the new machine is a great advantage. It is just the right height for good work in tamping. The workmen can get at it conveniently and if desired four men can tamp at one time and leave room for filling in the concrete. It is equally convenient for removing the block, which need be lifted only enough to get it off the base of the mold box. When the sides and ends are turned down they are free and clear making cleaning extremely easy. All the machinery is covered so that the cement and sand cannot get in to clog and wear it.

HOLLOW CONCRETE BLOCK CHURCH AT STAUNTON, VA.

H. S. Palmer Concrete Blocks.

The accompanying photographs show a church at Staunton, Va., under construction by the representative of the Palmer machine in that city and a residence built by the same firm. Full information about the new machine, which is styled the "self-closing automatic combination hollow block machine," will be sent by

the Harmon S. Palmer Hollow Concrete Building Block Co., 1450 Binney St., Washington, D. C.

Cement Workers' Tools.

The number of good firms supplying cement workers' tools is rapidly increasing. The firm of John Stortz & Son, Philadelphia, Pa., is one of the well established firms which has developed a long line of such tools, containing almost every variety that could be desired for regular and special work. Their catalogue shows many designs for corrugating and dot rollers and tools, name plates and letters, inside and outside circle and angle trowels, concrete and top cutters with and without handles, jointers and groovers of many designs and with all styles of handles, which should fit any possible situation, radius and bevel tools, step and curb edgers, coping and curb and gutter tools, simple and combined, smoothing trowels and floats of many shapes, sizes and styles of setting handles, tampers to suit any specification or location, for concrete, dirt and asphalt. They also have lines of street paving tools including rail and other tamping bars, curbstone lifts, brick and street paving hammers, cobble stone and block rammers, etc. The catalogue will be sent on application.

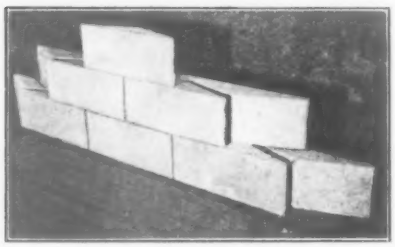
The Helm Hand Tamp Cement Brick Machine.

This is the latest model in cement brick machinery to be placed on the market by the Queen City Brick Machine Co., of Traverse City, Mich. It comprises the patented cell box and plunger feature which has made the Helm Press so successful and has been created to meet the demand for a tamp machine which would be exceedingly low in price yet give quality, quantity and variety of product. The machine will make any style, shape or design that could be desired. It is of especial value in making mantel brick for which there is a decided demand throughout the country. In describing one of the strong points of this machine this phrase is used, "On the pallet or on the ground," meaning the machine is operated with or without the use of pallets. In making 1,000 brick this effects a saving of $10.00 worth of equipment and owing to brick setting on pallets for at least two days it means a saving of two or three times that amount for each thousand of brick. Another point is that the brick can be faced without additional cost, using true concrete for the body, which will require three-quarters of a barrel of cement less, saving at least $1.00 to 1,000 brick. The material is tamped in the machine and stroked off, then the machine rolls over on the pallet or on moist sand, the levers

HOLLOW CONCRETE BLOCK RESIDENCE.

H. S. Palmer Concrete Blocks.

are operated and the ten brick are deposited. When used without pallets, moist sand is placed on the floor or ground and 2 by 4 pieces are imbedded therein for tracks for the machine to roll on. The brick are discharged on the moist sand, where they cure quickly and evenly, drawing moisture from the sand. The low price, the saving in equipment and the decreased cost of product makes this machine of economic value to every concrete plant or anyone using any quantity of brick.



PETERSON BROS. HOLLOW CONCRETE BLOCKS.

Machine for Making Cement Block, Brick and Sidewalk Tile.

A combination machine for making building blocks, cement brick and sidewalk tile is offered by Peterson Bros., of Omaha, Neb. It will make all sizes of blocks from brick up to stone with face 24 by 30 inches.

The accompanying photograph of the blocks shows that a continuous air space is formed in the wall with the header bond. The blocks are made face up and put under heavy pressure, so that a wetter mixture can be used than is usual and thus the blocks are made more dense. Any desired face can be put on the blocks, rock face, panel, smooth or ornamental cut.

The machine is shown in another of the accompanying cuts. Peterson Bros. are practical stone masons, and in their search for a concrete block machine concluded that they could improve on existing machines and that this is the result. The mold box is securely bolted down to the bottom plate and can be easily changed from one form of stone to another and extended for different sizes of blocks. When the mold box is filled with mixture a single revolution of the handle brings the pressure on the block. A reverse movement lifts the block out of the mold, when it is removed, turned on its side on a wooden pallet and set away to cure. The movement of another handle drops the filler block back into the mold box ready for another block. Thus it is not necessary to take the mold box apart to get a block out. Patents are pending on the blocks and have been applied for on the machine. Full information will be supplied by Peterson Bros. on application to their address, 1515 Burt St., Omaha, Neb.

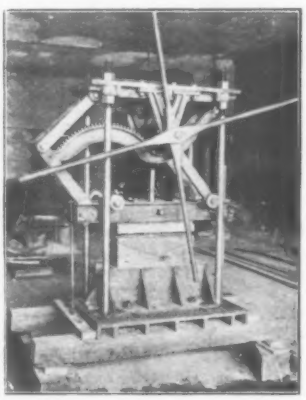
Bitulithic Pavement Infringement.

Proof is now being taken in actions brought by Warren Brothers Company against the several cities referred to for infringement of their patents as follows:

Owosso, Mich.—Patent No. 727,505, being patent for pavement issued to Frederick J. Warren, dated May 5th, 1903.

Duluth, Minn.—Patent No. 715,630, being patent issued to Frederick J. Warren for "Method of preparing the ingredients of street sheet pavements or roadways," issued Dec. 9, 1902.

Duluth, Minn.—Patents No. 725,641-725,642, being patents issued to Horace W. Ash, April 14, 1903, assigned to Warren Brothers Company, respectively covering "Apparatus for preparing material ingredients of bituminous mecadam or other pavements for use" and "Apparatus for grading minerals."



PETERSON BROS. HOLLOW CONCRETE BLOCK MACHINE.

Muskegon, Mich.—Patent No. 727,505, referred to above. In Muskegon action was started for infringement of patent No. 675,430, issued June 4, 1901, to Frederick J. Warren for "Pavement or roadway," but the complainants have decided, pending prosecution of patent No. 727,505, to temporarily withdraw the action on

patent No. 675,430. Warren Brothers Company claim that in each case infringement has occurred on a number of its other patents, but for the present they are only bringing action under those referred to above. In each case Henry L. Paul, Jr., of Philadelphia, is counsel for the defendants, and George O. G. Coale, of Boston, is counsel for the complainants.

Apartment House Built by the Hercules Method.

The United States Geological Survey has just issued a comparative table showing the production of minerals in the United States for the calendar years 1895-1904, in which the total production is stated to be in value in 1895 $620,767,222; in 1904, $1,289,660,778. Of this enormous sum building stone in 1895 amounted to $35,943,105, while the cement production was valued at $5,482,254. The relative production of stone and cement in 1904 stood: Stone, $74,200,361; cement, $26,031,920.

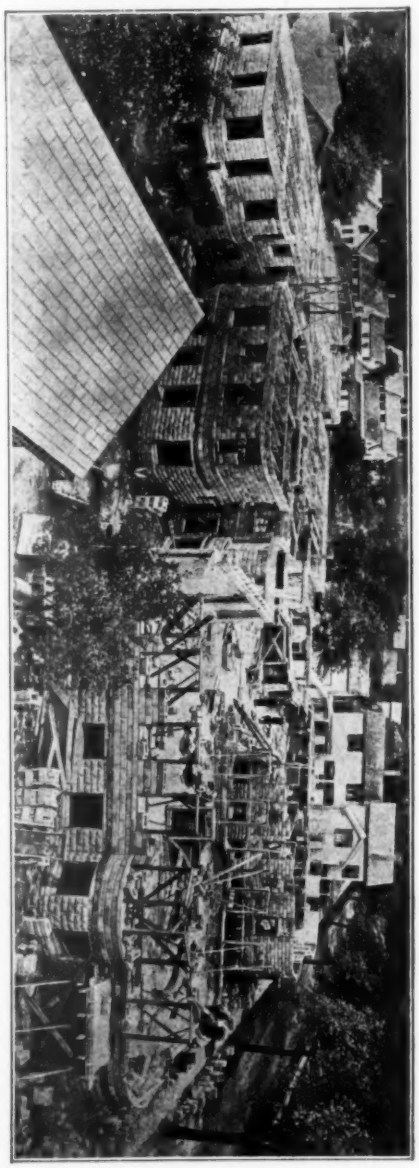
The relative value of stone and cement in 1895 was about $1 for cement to $7 for stone, while in 1904 it stood more than $1 for cement to $3 for stone.

This enormous increase in the relative consumption of stone and cement in the past nine years has been due to a very large extent to the production of such mechanical aids to the use of cement as the Hercules cement-stone machine, manufactured by the Century Cement Stone Machine Company, of Rochester, N. Y. This machine enables the builder to produce hollow building blocks of any size or shape, from two inches to six feet long, together with such ornamental work as coping, sills, lintels, water table, pillars, friezes, etc., so that to-day a builder can produce with this one machine and the aid of a little Portland cement and a good deal of gravel or crushed stone a complete edifice in the colonial style, for example, with ornamental columns extending from the ground floor to the roof, with all the trimming and relief work desired and without employing any other material. This wonderful development in the manipulation of cement, together with the simplicity and low cost of machines, is bound to revolutionize building methods. The builder, contractor or dealer in building materials who is looking at the big things of the future will do well to investigate the possibilities of the Hercules machine.

The accompanying photograph shows a large apartment house in Springfield, Mass., under construction by the Hercules method.

The Development of a Concrete Wall Machine.

The Concrete Stone and Sand Company, of Youngstown, O., was organized to handle sand and gravel. In the course of their business they found that the local



CONCRETE BLOCK APARTMENT HOUSE, SPRINGFIELD, MASS. Hercules System.

contractors could not be induced to use concrete in foundations of buildings because, as they reported, they could not compete with other building materials and buy the lumber and put up the forms required for the concrete.

Mr. A. A. Pauly, the manager of the Concrete Stone and Sand Company, believing that a practicable form could be invented, made a number of different forms and models and showed that his ideas were correct. He induced a practical cement man to form a company to make cellar walls with the machine, and after enough experience to learn how to handle the new material and apparatus they made structures that are entirely satisfactory. This is shown by the fact that during the season they have put up thirty-five or forty jobs measuring from fifteen to one hundred perches each, and are full of business, with four gangs operating the machine.

Mr. Pauly is studying the machine at work and devising improvements, and states that he can erect a cellar for a residence at a cost of 50 cents a cubic yard for labor. He is ready to give any information and to show the machine at work. Details can be obtained from him if addressed in care of the Concrete Stone and Sand Company, 937 Poland avenue, Youngstown, O.

Bowen's Formula, Cement Bricks and Blocks.

The Keokuk Cement Brick and Block Co., is the title under which R. H. Bowen is now operating. He says that he has improved his chemical formula so that it will set the blocks and bricks even more quickly than heretofore. He sends some affidavits from W. E. Lee, of Mankato, Kan., one stating that he made brick of one part Louisville cement and three parts sand using the Bowen formula for crystallizing the sand and cement and that the brick were handled and put in ricks by a ten-year old boy in fifteen hours after taken from the press and every brick was in perfect form and condition.

The other made a similar statement, except that the proportions of materials were one part Portland cement and five parts sand, that one thousand of the brick were made and that they were put in shed by the boy in ten hours after removal from the press.

Mr. Bowen's plant is making brick on a brick machine, tamping the concrete and making seven brick with each operation of the machine. The mortar is mixed in a machine mixer of his construction. One man at the mixer and two men at the machine turn out 3500 brick a day. With three machines, one mixer and seven men the capacity of the plant is estimated at 10,000 brick a day.

The company will furnish and set up these plants as well as plants for making concrete blocks anywhere that they are wanted and have the improved Bowen chemical formula on sale. Write the company for particulars at 314 Johnson street, Keokuk, Iowa.

Decision Regarding Incandescent Burner Patents.

Suit having been brought in the Circuit Court of the United States for the District of Rhode Island against the Cleveland Vapor Light Company, of Cleveland, O., for infringement of patent 447,757, issued to Harry C. Campbell for improvement in incandescent burners using gasoline and method of using them, a petition for a preliminary injunction to prevent the use of the devices complained of during the pendency of the suit was heard by Judge Brown September 14, 1905.

After a review of the state of the art as shown by the patents brought into the case, the court denies the petition on the ground that "the question of invention (by Campbell) seems doubtful, even if Campbell, by the use of a gauze dome upon his burner similar to that shown in the Welsbach arrangement, secured a more efficient application of heat to the refractory material than did Cooper," to whom was issued a prior English patent not valid in this country.

Qualities of the Hall Cement Brick.

The Hall cement brick machine is strong and durable and the best material and workmanship has been used in its construction. The working parts are solidly built, and the wear on these being slight, the machine will not wear out. Skilled labor is not required to make the brick or run the machine. The entire operation is very simple and may be learned by any one in an hour.

The machine will make common, front or ornamental brick of any thickness up to three inches. Extra molds for making any size brick can be furnished. These are readily adjustable to any of the machines. Common cement brick made with this machine are better than those of any other material or manufacture. They are harder, stronger, less porous than clay brick and are fire-proof. They are square, smooth, of uniform color and the finished work is of excellent appearance. The front brick are equal to any pressed front brick made. The natural color is a rich gray but any color can be obtained. Rock-facing can be quickly and easily done be-

fore the brick have become hard. Brick so treated make a handsome front.

The cost of the brick can be computed for any locality from the statement that 1,000 brick, 8 by 3 7-8 by 2 3-8 inches, require 1 5-8 barrels of cement and 45 cubic feet of sand, and that 2 men can made 2,000 brick a day on the machine. They can thus compete in price with brick for similar uses and are at a special advantage in the fancy front brick trade.

Garbage and Refuse Destruction.

The Decarie Manufacturing Company, of Minneapolis, Minn., has just issued a catalogue which gives the first complete showing of the construction and method of operation of the Decarie Patent Incinerator. This furnace for the sanitary destruction of garbage and refuse has been in successful operation in Minneapolis for several years, and the catalogue shows several letters from Minneapolis city officials, expressing their satisfaction with its construction and operation.

There are also letters from Johnstown, Pa., Spokane, Wash., and Tampa, Fla., where they have had furnaces in operation for a year or two. The editor tried in the September number of locate the Spokane plant at Seattle, but without success, except so far as the printed words go.

The company will send the catalogue on application, and also a reprint of the excellent paper on "The Incineration and Cremation of Municipal Waste," which Howard G. Bayles read at the recent convention of the American Society of Municipal Improvements, giving comparative figures of cost of operating garbage destructors in various cities. The Decarie furnace makes the best showing, the plant at Atlanta being the most economical plant which has yet been constructed on any system. This plant has been operating for some months in a central location in the city without nuisance.

Concrete, the Modern Stone.

Of all building materials produced, concrete is the most universal in its application, the most durable, and when properly handled, the most beautiful, at the same time one of the least expensive. The Century Cement Machine Company, of Rochester, N. Y., produces simple, practical and durable machines for the making of a great variety of cement building blocks and ornamental parts, such as sills, coping, lintels, pillars, capitals, bases, pilasters, etc. Variety is necessary in order to relieve the monotonous effect produced by making an entire building of blocks having the same face design, and their constant effort has been to produce as large a number of natural forms of rock faces as possible, in order that the contractor may build a structure having as great variety as natural stone, with no added expense beyond the primary cost of the face plates needed to produce the designs. Even this cost has been reduced to a minimum.

Their latest achievement is in the production of molds for the making of bases, columns and capitals, by the use of which the most striking and stately architectural effects can be produced entirely of concrete and at a cost which would be totally prohibitive were it necessary to use natural stone. The accompanying illustrations show some of the designs for these special ornamentations, which are made on this company's machines.

A High-Grade Concrete Block Machine.

C. M. Runyan & Co., Elyria, O., have a concrete block machine for which they make claims of exceptional qualities. It is termed the simplest block machine, having the fewest parts and none of them complicated, and that it can be operated by one person with a minimum of effort. It has no cog wheels nor racks but operates by levers and counterweights which are patented. It can make solid or hollow blocks of any size or shape within the dimensions of 16 by 40 inches and can be changed from one to another in three minutes, and uses one width of pallet on which to make five different widths of blocks, also a specially patented feature. The machine makes blocks face downward and is said to be the only block machine that will make window and door caps and sills and paving blocks.

C. M. Runyan & Co., Elyria, O., will undoubtedly furnish on application their reasons for making these claims for their machine, which should under the statement make a large number of blocks a day of good quality and of the greatest variety, thus filling the requirements of the building trade.

Trade Publications.

Bulletin No. 10 of the Jeffrey Manufacturing Company, Columbus, O., on mining machinery is devoted to electric locomotives.

The Sicilian Asphalt Paving Co., 41 Park Row, New York city, issues a booklet on waterproofing, describing the meth-

ods of using Carboron cold waterproofing for waterproof layers, damp courses, roof coverings, wrapping joints of vitrified pipe, etc.

"Eternal Summer" is the title of a handsomely illustrated booklet issued by W. H. Schott, Chicago, Ill., which describes the hot water heating plant in Terre Haute, Ind.

The Philadelphia Iron Works, 18th and Pennsylvania Ave., Philadelphia, Pa., issues an illustrated catalogue and price list showing the styles and dimensions and details of boiler, stacks, tanks and standpipes built by them.

The Economy Drawing Table Co., Toledo, O., issues a complete catalogue showing their line of drawing tables, sectional filing cases and other special furniture for engineers, architects, draughtsmen, contractors, schools. The large number of these tables used in the great drawing rooms of steel structural and other large works is evidence of their adaptability to the needs of the trade.

Trade Notes.

BRICK.

Leon, Ia.—A company may be formed here to install a plant for making paving brick and drain tile from clay suitable for that purpose, which has been found on land owned by W. H. Jenkins and E. H. Lewis.

Macomb, Ill.—The Clay Products Co. is being organized here to manufacture clay products, by John H. Millson, J. L. Scott and Emmet Arnold.

Salina, Kas.—The Salina Brick Co. is adding paving brick equipment to its plant.

Albion, Ill.—The Edwards Vitrified Brick & Sewer Pipe Co. has been incorporated by G. F. Martin, Frank Gillard and W. F. Elliott.

Saxton, Pa.—The Saxton Vitrified Brick Co. has been incorporated with S. B. Stober, of this city, at its head.

CEMENT.

East St. Louis, Ill.—The Acme Cement Co., of this city, has been incorporated under the laws of Oklahoma, by J. A. Stoddart, M. J. Sheridan and C. H. Rose, of Chicago. Charles Vestal, of Cement, Ok., is territorial agent.

Ann Arbor, Mich.—The White Portland Cement Co., of Four-Mile Lake, made an assignment to A. C. Guyon, of Chelsea, for the benefit of creditors. The company's liabilities are $262,631, and assets $64,612. W. J. White is chief creditor, his claim being $234,600.

Dixon, Ill.—The company composed of Toledo and Sandusky capitalists, recently organized to develop extensive gypsum mines in Ohio and Illinois, has secured leases on deposits near this city and will develop them. The company also owns valuable gypsum lands near Castalia, O.

Middlebranch, O.—The Diamond Portland Cement Co. is building an addition to its plant and putting in new machinery for doubling the capacity of its plant. The new equipment will be ready for operation by December 1.

Iola, Kas.—The Portland Cement Co., of this city, will build a branch cement plant at Independence, Kas., at a cost of $1,000,000. E. C. Soper, formerly chief engineer of the Hecla Cement Co., Bay City, Mich., will be in charge of the plant.

Norfolk, Va.—The American Cement Co., which was recently awarded large contracts for supplying cement for the Panama canal, will build cement works on the southern branch of the Elizabeth river, near here, at a cost of $1,000,000. The extensive marl beds of the Isle of Eight, Nansemond, and Surrey counties, Va., have been purchased.

Newark, N. J.—The International Armored Cement Co. has been incorporated here by F. W. Scofield, of the City of Mexico; D. H. Miller, East Orange; Oscar C. Kunze, city.

Louisville, Ky.—The Portland cement plant being erected at Speeds, 10 mls. north of Jeffersonville, Ind., by the Louisville Cement Co., will probably be ready to begin grinding by January 1.

CONCRETE BLOCKS.

Noble, Ill.—The Portland Concrete Co. has been incorporated to manufacture blocks, building materials and concrete by E. L. Palmer, A. Shannon, F. M. Foster and Charles E. Palmer.

Deshler, O.—The U. S. Machine Co. has been incorporated by F. Henry Meyer, president; S. A. Jones, vice-president; S. Cottingham, treasurer; J. B. Gibbell, secretary.

Lancaster, O.—The Lancaster Stone Co. has been organized and will manufacture clay and cement products. The incorporators are E. M. Fullington, J. E. Ellis, C. S. Frambes, J. A. Taft and F. H. Hertel, of Columbus.

Morocco, Ind.—Experts have been examining the sand in parts of Newton county, and they pronounce it suitable for the manufacture of cement stone, glass and a number of other articles.

Bay City, Mich.—J. H. Emery will begin at once the erection of buildings on the property he recently leased, where he will manufacture Emery cement machines. He will continue the manufacture of cement brick, building blocks, etc.

New concrete plants have been organized since the issue of the October number of MUNICIPAL ENGINEERING as follows:

Pilot Mound, Ia.—J. O. Thorngren.

Bay City, Wis.—L. O. Snow and Andrew Norden.

Norwood, Minn.—Bradley & Bauermeister.

Roseau, Minn.—Ekman & Rice.

Early, Ia.—C. C. Wetstein.

Towner, N. D.—W. H. Jones, of St. Paul.

Grand River, Ia.—Dr. Bone and George Lee.

Delano, Minn.—John Naslund.

Park Rapids, Minn.—G. H. Rice.

Eliza, N. D.—Jos. Shimek.

New Richmond, Wis.—A. R. Kibbe and E. J. Bell.

Des Moines, Ia.—The Iowa Construction Co.: M. M. Robertson, Reason S. Jones, A. C. Miller.

Perham, Minn.—M. J. Palubicki.

Pierre, S. D.—Capital City Cement Co.: Florence M. Wimmer, Chaster W. Tuttle, William J. Lee.

Eau Claire, Wis.—Northwestern Steel & Iron Co.

Colo, Ia.—Colo Cement, Stone & Tile Co.: President, E. A. Binder; manager, Jas. McCoy; secretary and treasurer, W. F. Shaw.

Red Lake Falls, Minn.—Herman Lin-

der will manufacture cement sidewalk squares.

Ivanhoe, Minn.—Olson Bros. are manufacturing cement blocks for chimney use.

PURCHASE OF MATERIALS.

Tarrytown, N. Y.—Special.—A. E. Bliss, 20 Depot Square, advises us that he desires to purchase concrete block machinery and curbing and sidewalk tools.

Bluefield, W. Va. — Special. — J. J. Francisco, St. Com'r, is in the market for plows, street sweepers, fire hose, sewer tools, hook and ladder wagons, fire engines and all kinds of city supplies.

Ava, Ill.—Special.—A. L. Smith advises us that he is in the market for tools for brick, stone and concrete work.

Walworth, Wis.—Special.—C. R. Colburn is in the market for a good, practical sill mold.

Catlettsburg, N. Y.—Special.—John McDryer desires to purchase a concrete mixer.

Indianapolis, Ind.—Special.—J. R. Fry, 360 Burgess Ave., desires a concrete form for making cisterns.

Atlanta, Ga.—Special.—H. L. Collier, com'r pub. wks., advises us that this city is in the market for a 12-ton steam road roller.

Iowa City, Ia.—Special.—James W. Berry advises us that he is in the market for a small concrete mixer.

Kansas City, Mo.—Special.—M. H. Gray desires the names of firms manufacturing cement block machines.

Philadelphia, Pa.—Special.—C. P. Calver, 4010 Locust st., is in the market for cement block machines, cement tools and general tools.

Fredonia, Ia. — Special. — Crull Bros., who have just begun making cement blocks and brick, are in the market for machinery for cement brick and tile.

Sutton, Neb. — Special. — Brown Bros., Box 12, are in the market for cement block and sidewalk tile machines.

Iola, Kas.—Special.—Geo. Myers, cy. engr., desires to purchase a 10-ton, 3-wheel steam road roller.

Anderson, Ind.—Special.—Gedge Bros. Iron Roofing Co. desires the names of manufacturers of combination grading, ditching and wagon-loading machines.

Batavia, O.—Special.—J. L. H. Barr is in the market for coloring matter for cement blocks and plaster, and desires to correspond with firms selling it.

Fredonia, Ia.—Special.—Crull Bros., who have just begun making cement blocks and brick, desire to purchase cement and crushed rock.

Catlettsburg, N. Y.—Special.—John McDyer desires to purchase cement.

Ava, Ill.—Special.—A. L. Smith advises us that he is in the market for cement, sand and rock.

Bluefield, W. Va.—Special.—J. J. Francisco, st. com'r, desires to purchase cement and sewer pipe.

Dayton, O.—Special.—The Rice Wall Plaster Co. desires the names of Portland cement companies.

Gainesville, Fla.—Special.—E. W. McMahan advises us that he is in the market for cement.

Tarrytown, N. Y.—Special.—A. E. Bliss, 20 Depot Square, advises us that he is in the market for cement, lime, etc.

Sutton, Neb.—Special.—Brown Bros. Box 12, desires to purchase cement in car lots.

Gainesville, Fla.—Special.—E. W. McMahan says he may desire to purchase machinery and tools in the near future.

LIGHT, HEAT AND POWER.

New electric light and gas companies have been incorporated as follows:

Rochester, N. Y. — Holland-American Construction Co., to construct railroad, power and electric plants, etc.: Chas. H. Palmer, John N. Beckley, J. George Kaelber, John F. Alden and Geo. C. Buell.

Van Buren, Ark.—Van Buren Electric Light & Power Co.: John E. Powers, pres't; Henry L. Fitzhugh and Sydney A. Pernot.

Pikeville, Tenn.—The Pikeville Electric Light Co.

MISCELLANEOUS.

Memphis, Tenn.—The Memphis Sand & Gravel Co. has been incorporated by Harry P. Johnson, C. H. Raine, F. H. Carlisle, A. S. Caldwell and B. L. Mallory. The company will take sand and gravel from the Mississippi river just north of Nonconnah, by means of a dredge boat. About $150,000 will be expended on the unloading plant, dredge boat, barges, dumping bin, etc.

New York City—The Breakwater Construction & Engineering Co. has been incorporated by Chas. L. Brookhelm, Arthur T. Parkhurst, Jerome C. Jackson, all of this city.

Patents of Interest to Municipalities and Contractors.

778,903. Jan. 3, 1905. Root Cutter for Drain Pipes. Wilhelm Schuessler, Berlin, Germany.

778,934. Jan. 3, 1905. Street Sprinkler. James Wilson, St. Louis, Mo.

778,954. Jan. 3, 1905. Combined Garbage-Burner and Water Heater. John J. Dube, Chicago, Ill.

778,960. Jan. 3, 1905. Combined Water Heater and Garbage Crematory. John S. Erikson, Chicago, Ill.

778,051. Jan. 3, 1905. Garbage Can. Nicholas N. S. Matcovitch, Oakland, Cal.

779,293, 779,294, 779,295, 779,296. Jan. 3, 1905. Roadway. David N. Long, Buffalo, N. Y.

779,316. Jan. 3, 1905. Automatic Thaw-Out for Water Pipes. Wm. J. Robinson, Smyrna, Del.

779,415. Jan. 10, 1905. Trenching Machine. Lewis A. Desy, Montreal, Can.

779,513. Jan. 10, 1905. Road Grader. Wm. N. Williams, Welcome, Minn.

779,604. Jan. 10, 1905. Composition for Roadway Surfaces. John E. Jones and Michael Meehan, Boston, Mass.

780,669. Jan. 24, 1905. Street Sweeping Machine. Bernhard Kraft, Philadelphia, Pa.

781,014. Jan. 31, 1905. Street Receiver. Thos. J. O'Brien, Buffalo, N. Y.

781,079. Jan. 31, 1905. Method of Forming or Treating Roadways. Frederick W. A. Loebell, Muegeln, near Dresden, Germany.

781,543. Jan. 31, 1905. Street Cleaner. David G. McClay, Santa Ana, Cal.

781,988. Feb. 7, 1905. Roadway. Charles W. Baker, Montclair, N. J.

782,026. Feb. 7, 1905. Water Sprinkler or Street Washer. Edward Henry, East St. Louis, Ill.

782,040. Feb. 7, 1905. Apparatus for Raising Liquids from Deep Drilled Wells. Thos. F. Moran, De Young, and Fred J. Moser, Kane, Pa.

782,270. Feb. 4, 1905. Road Making Machine. Stephen Randall, Russell, Ia.

782,576. Feb. 14, 1905. Conduit for Electric Wires. Robert W. Lyle. New York, N. Y.

783,146. Feb. 21, 1905. Asphalt Machinery. Frank B. Smith, Omaha, Neb., and Henry R. Kasson, Chicago, Ill.

783,385. Feb. 21, 1905. Street Sweeper. Henry M. Ramsay, Houston, Texas.

783,473. Feb. 28, 1905. Apparatus for Evaporating and Burning Refuse Matter. Fred P. Smith, New York, N. Y.

783,474. Feb. 28, 1905. Evaporating Excretal Closet. Fred P. Smith, New York, N. Y.

783,475. Feb. 28, 1905. Drying and Cremating Apparatus for Refuse Matter. Fred P. Smith, New York, N. Y.

783,476. Feb. 28, 1905. Continuous Drying and Burning Furnace. Fred P. Smith, New York, N. Y.

783,484, 783,485. Feb. 28, 1905. Water Meters. John Thomson, New York, N. Y.

783,486. Feb. 28, 1905. Meter. James A. Tilden, Hyde Park, Mass.

783,556. Feb. 28, 1905. Catch Basin Top. Robert M. Van Buskirk, Tipton, Ind.

783,702. Feb. 28, 1905. Manhole Cover. David E. Olds, Newark, N. J.

784,297. March 7, 1905. Street Sprinkler. William J. Bole, Philadelphia, Pa.

784,304. March 7, 1905. Sewer Cleaning Device. Michael T. Connolly, Jersey City, N. J.

784,597. March 14, 1905. Apparatus for Pumping Sewage and Consuming Garbage. Fred P. Smith, New York, N. Y.

785,134. March 21, 1905. Flushing Gate for Sewers, etc. George S. Walker, Boston, Mass.

785,185. March 21, 1905. Apparatus for Handling Sewage and Clarifying Septic Matter. Fred P. Smith, New York, N. Y.

785,396. March 21, 1905. Bituminous or Other Pitch Concrete Pavement. Joseph H. Aimes, Philadelphia, Pa.

785,650. March 21, 1905. Pitch Cement Concrete Pavement. Joseph H. Aimes, Philadelphia, Pa.

785,769. March 28, 1905. Apparatus for Purifying Septic Matter and Manipulating Sewage. Fred P. Smith, New York, N. Y.

785,923. March 28, 1905. Meter System. James A. Tilden, Hydepark, Mass.

786,108. March 28, 1905. Road Smoother. Jefferson Force, Craig, Neb.

786,319. April 4, 1905. Composite Paving Block. Alexander F. Shuman, Chicago, Ill.

786,329. April 4, 1905. Piling. Mathias R. Vanderkloot, Chicago, Ill.

786,522. April 4, 1905. Asphalt Cutting Machine. Henry Schumacher, Buffalo, N. Y.

787,040. April 11, 1905. Apparatus for Excavating Trenches, etc. Wm. Heffron, Cincinnati, O.

12,337. (Reissue.) April 11, 1905. Connection for Sewer and Soil Pipes. Wm. F. J. Lutz, Chicago, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Newark, N. J.—Chief Justice denied, October 16, the application of the Barber Asphalt Paving Co. to have set aside the writ of certiorari granted by the court to review the action of the Board of Works in awarding the contract for paving the approaches to the Sixth-avenue bridge to that company. The case will come up before the Supreme Court for argument November 1.

New York City.—George R. Olney, city engineer, decided Oct. 16 that the wood-block pavement laid a month before on Chambers street, from Broadway to West street, at a cost of about $15,000, would have to be taken up and relaid almost its entire length. The merchants in Chambers street called attention to the fact that the pavement was sinking under the heavy travel in the street and that the blocks were unevenly laid. The pavement was constructed by the Franklin Contracting Co., a new concern, at a cost of $2 50 a square yard.

Niles, Mich.—Property owners have made application to Judge Coolidge, in the Circuit Court, for an injunction restraining the Barber Asphalt Paving Co., of Detroit, from carrying out its contract to pave Fourth street. It is claimed that the city has already appropriated all the money that is permissible this year, and that the funded debt is so large now that it will require $14,975 to meet the interest and retire the bonds annually, whereas, under the charter, this sum should not exceed $5,850 on the present assessment.

Hagerstown, Md.—This city has been experimenting in paving the streets, under the supervision of the street superintendent, with the result that the city can do the work at a great saving to the taxpayers. The work of paving 5,500 sq. yds. of Antietam street has just been completed, at a cost of $1.23 a sq. yd. Hammond vitrified brick, manufactured at Fairmont, W. Va., were used. The brick was laid on a macadam bed covered with sand, after which cement mixed with water was poured over the entire brick surface. A total of 226,000 brick, 471 tons of sand and 146 barrels of cement were used. The cost of labor was $542, and the total cost of paving was $6,832.32. Brick paving by contract has cost heretofore $2 a sq. yd.

CONTEMPLATED WORK.

Green Island, N. Y.—The taxpayers have decided to pave George street.

Glenwood, Ill.—Considerable paving is contemplated for next spring.

Sterling, Ill.—Grading, curbing and paving is proposed for East Third street.

Anderson, W. Va.—This city voted to issue bonds for street improvements.

Winterset, Ia.—The north side of the public square will be macadamized.

Pine Bluff, Ark. — City council has appropriated $12,000 for paving Main street.

Brainerd, Minn.—Macadam paving is proposed for Eighth street, from Laurel street to Front street.

Albany, N. Y.—Paving is proposed for Clinton avenue. Walter Melius, cy. engr.

South Orange, N. J. — Vitrified brick paving is contemplated for Main street.

Akron, O.—Another ordinance has been passed for paving Lods street.

Lexington, N. C.—This town voted to issue $5,000 bonds for improving the sidewalks.

Sheboygan, Wis. — This city contemplates considerable macadam paving next spring.

Hazelton, Pa.—An ordinance has been adopted for the issue of $35,000 for street paving.

Evanston, Ill. — Ordinances have been passed providing for macadam paving on sundry streets.

Minneapolis, Minn. — The repaving of Nicollet avenue with creosoted wood blocks has been suggested.

Paducah, Ky. — The improvement of several streets is contemplated. L. A. Washington, cy. engr.

Washington, Pa.—About 8,800 sq. yds. of brick paving is contemplated. O. K. Taylor, Jr., cy. engr.

Norwalk, O. — A resolution has been passed for paving East Main street with brick. T. P. Kellogg, cy. clk.

Bangor, Me.—Bids will be asked for 250 sq. yds. of wood block paving on Main street. Mayor Peirce.

Alton, Ill.—Bids will be asked this winter for about 6 mis. of brick paving. T. M. Long, cy. engr.

Sea Isle City, N. J.—This city will vote November 28 on the issue of $20,000 for municipal improvements.

Jefferson City, Mo.—The question of issuing $200,000 bonds for road improvements will be voted on November 11.

Dandridge, Tenn.—The question of issuing $200,000 bonds for road improvements will be voted on November 11.

Lake Forest, Ill. — An ordinance has been passed for paving Westminster, Linden and Illinois avenues with macadam.

Hinsdale, Ill.—Bids will be received about June 1 for about 500,000 sq. yds. of cement walks. J. W. Nicholson.

Bucyrus, O.—The contracts for paving Locust and Prospect streets will be let next year. C. P. Bryant, cy. engr.

Pueblo, Col.—Property owners are signing a petition for paving Main street and the cross streets between First and Tenth.

Akron, O.—Sherman street is to be paved with asphalt blocks from Exchange street to South street. J. W. Payne, cy. engr.

Fort Smith, Ark.—The question of resurfacing with asphalt the brick pavement on Garrison avenue is being considered.

Ashland, O.—Bids will be asked about April 1 for five blocks of asphalt paving on Walnut street. C. P. Winhigler, Mayor.

Decatur, Ga.—This city contemplates the issue of bonds for improving the streets and sidewalks. Howell C. Erwin.

Harrisburg, Pa.—This city will vote November 7 on the question of issuing $100,000 bonds for street improvements.

Atchison, Kan.—Resolutions have been passed providing for 2,305 sq. yds. of brick paving and 1,280 lin. ft. of curbing.

Martin's Ferry, O.—An ordinance has been approved for paving Sixth street, from Walnut to Center, with brick. Frank Heinrich, mayor.

Salt Lake City, Utah.—A resolution has been passed providing for macadamizing Eighth West street between Second and Eighth South streets.

Niles, N. Y.—The question of issuing bonds for the proposed new street to the Russia Field will probably be voted on in November.

Reading, Pa.—A resolution has been passed providing for an appropriation of $10,000 for repairing pavements throughout the city.

Mattoon, Ill.—An ordinance has been passed for paving Charleston avenue with brick, with concrete curb and gutter. Claude L. James, cy. engr.

Cape May, N. J.—The county engineer has been directed to prepare plans for building a new driveway from Sea Isle City to the mainland.

Waukegan, Ill.—Bids will be asked soon for granite-top macadam paving in Sheridan road district. About one mi. of brick paving is also contemplated.

East St. Louis, Ill.—Ordinances have been passed for paving Ninth street and St. Clair avenue with brick, with stone curbing. W. J. Crocken, cy. engr.

Dallas, Tex. — This city contemplates paving Ervay street with asphalt or bituminous macadam, and Second avenue with macadam. J. B. Winslett, cy. secy.

Little Rock, Ark.—Asphalt paving is contemplated for four blocks of Center street. About twenty blocks of Tenth street will be paved. W. A. Plunkett, Sec. B. Comrs.

St. Louis, Mo.—Ordinances were approved October 16 for paving a number of streets with brick and constructing granitoid walks on a large number of streets. B. P. I.

Walla Walla, Wash.—The specifications for paving Spokane, Elm and North Fourth streets will be changed to admit competition. The specifications provided for bitulithic only.

Cincinnati, O.—Specifications have been submitted for paving Sherman avenue, from Western avenue to McLean avenue, with asphalt, and Moorman avenue, between McMillan and Clayton streets, with bitulithic.

CONTRACTS TO BE LET.

Burlington, Vt.—Bids are asked until November 6 for paving Kansas avenue.

Bloomfield, Ind.—Bids are asked until November 7 for constructing two mis. of gravel road. Co. Comrs.

Mooresville, Ind.—Bids are asked until November 7 for constructing two and a half miles of concrete sidewalks. Bd. Town Trustees.

Bemidji, Minn.—Bids are asked until November 6 for constructing several sections of county road. John Wilmann, Co. Audt.

Franklin, Ind.—Bids are asked until October 31 for constructing cement sidewalks on West Jefferson street. Arthur R. Owens, cy. clk.

Atlantic City, N. J.—Sealed bids are asked until November 6 for furnishing yellow-pine lumber to repair the board walk. Cy. Clk.

Hannibal, Mo. — Bids are asked until November 6 for constructing concrete and granitoid walks on Palmyra avenue. S. A. Birch, cy. clk.

Pipestone, Minn.—Bids are asked until November 3 for constructing 500 yds. of cement sidewalk. Willard S. Campbell, Supt. U. S. School.

Moundsville, W. Va.—Bids are asked until November 6 for paving Baker and Thompson avenues with vitrified brick. Walter A. McGlumphy, cy. clk.

Bisbee, Ariz.—Sealed bids are asked until November 7 for 3,600 sq. yds. of brick paving on Main street and Brewery avenue. C. W. Hicks, cy. clk.

Cincinnati, O.—Sealed bids are asked until November 10 for constructing drains and remetaling Deerfield road, in Sycamore twp. E. L. Lewis, co. audt.

English, Ind.—Sealed bids are asked until November 6 for constructing macadamized roads in Jennings twp. and improving a street in Leavenworth. Bd. Co. Comrs.

Martinsville, Ind. — Sealed bids are asked until November 7 for building a gravel road in Clay twp. Frank E. Carlisle, chmn. co. comrs.; B. R. Johnson, co. audt.

Cincinnati, O.—Bids are asked until November 1 for paving Wade street with asphalt, and until November 6 for paving Celestial street with bitulithic. Geo. F. Holmes, clk. B. P. S.

Perth Amboy, N. J.—Sealed bids are asked until November 6 for paving Rector street, from Market to Smith, with Telford macadam, with Belgian block gutters. Wm. Fullerton, st. comr.

New Orleans, La.—Bids are asked until November 25 for curbing and sidewalks at the naval station, this city. Mordecai T. Endicott, chmn. bureau yds. and docks, Navy Dept., Washington, D. C.

Harrison, N. J.—Sealed bids are asked until the regular meeting in November for 7,600 sq. yds. of Telford paving on Hamilton street, with curbing, fourteen manholes, etc. B. F. Walsh, town clk.

Norwood, O. — Sealed bids are asked until November 4 for macadamizing and graveling and constructing artificial-stone sidewalks, etc., on Section, Norwood and Montgomery avenues. J. E. Thorpe, clk. B. P. S.

Danville, Ind.—Sealed bids are asked until November 7 for constructing 13,574 ft. of gravel road on the Stilesville and Monrovia road, and 10,750 ft. on Eminence road. John A. Mattern, chmn. co. comrs.; David D. Mills, co. audt.

Cincinnati, O.—Sealed bids are asked until November 1 for constructing a concrete retaining wall between East Sixth and Russell streets, north of East Court street, and improving East Court street. Sealed bids are asked until November 9 for improving Cinnamon street by paving with brick. Geo. F. Holmes, clk. B. P. S.

CONTRACTS AWARDED.

Watertown, N. Y.—Daniel Coleman secured the contract for macadamizing Pearl street for $8,040.

Albany, Ga.—The contract for three blocks of vitrified brick paving on Washington street was awarded to the Southern Concrete Construction Co. for $22,700.

Erie, Pa. — The contract for paving Myrtle street with asphalt was awarded to Maver Bros. for $3,700.

Southboro, Mass.—L. C. Carchia was awarded the contract for building a piece of State road for $4,161.

Newark, N. J. — A. E. Sargent was awarded the contract for grading, curbing and guttering a number of streets.

Walla Walla, Wash.—A contract has been awarded Warren Bros. Co. for 5,143 sq. yds. of bitulithic paving on Palouse street.

Jackson, Ky.—The contract for macadamizing four central streets in this city was awarded to Oscar Hagins & Co. for $7,250.

Hutchinson, Kan.—Special.—A contract has been awarded Warren Bros. Co. for 30,000 sq. yds. of bitulithic paving on Avenue A.

Galion, O.—The contract for paving the South Market-street extension with Massillon block was awarded to A. J. Stough for $4,990.12.

Evansville, Ind.—The Barber Asphalt Paving Co. was awarded the contract for paving Sixth and Walnut streets and Riverside avenue with asphalt.

Salem, Mass. — Special. — The contract for 3,500 sq. yds. of bitulithic paving on Lafayette street has been awarded to Warren Bros. Co., of Boston.

Columbus, Ga.—A contract for 15,000 sq. yds. of bitulithic paving has been awarded to the Southern Bitulithic Paving Co., of Nashville, Tenn.

Spencer, N. C.—This city awarded a contract for paving streets and sidewalks and building a sewer system to C. Markley, of Roanoke, Va., for $35,000.

Muskegon, Mich.—The Barber Asphalt Co. was awarded a contract for paving Fourth street with macadam at $1.71 a sq. yd. and Jackson street at $1.73 a sq. yd.

Johnstown, N. Y.—The Hastings Pavement Co., 25 Broad street, New York city, was awarded contracts for asphalt block paving on Market street for $27,361, and Perry street for $5,117.

Marion, Ind.—The Oakdale Co. awarded the contract for grading and graveling about twelve mis. of sidewalks in Oakdale suburb to Benjamin J. & Allen G. Trippeer for $23,800.

Trenton, N. J.—The Barber Asphalt Paving Co. has been awarded the contract for paving Ogden street, Hanford place and Stockton street with asphalt. J. H. Caldwell secured the contract for macadamizing Monmouth street.

Columbus, O.—Contracts for the repair of streets were awarded October 10 as follows: West Park avenue, W. H. Ralston; Spruce street and an alley, Geigeley & Garnes; McCoy street, Buckeye Engineering & Const. Co.; Space street, A. G. Pugh.

Milwaukee, Wis. — Special. — The contract for resurfacing with bitulithic the asphalt pavement on Wisconsin street, 1,328 sq. yds., was awarded to Warren Bros. Co., who also received contracts for 1,349 sq. yds. on Brady street and 9,809 sq. yds. on Kinnickinnic avenue.

Kansas City, Mo. — Contracts under open specifications were awarded to the Cleveland Trinidad Paving Co. as follows: Monroe street, from Windsor to Smart, $1.94 a sq. yd.; Fortieth street, from Genessee street to the State line, $1.92 a sq. yd. Former prices for asphalt paving here have been $2.15 and $2.20.

Springfield, Ill.—The contract for paving West Grand avenue with asphalt was awarded to the Barber Asphalt Co. at $1.78 a sq. yd. for paving and at 55 cts. a lin. ft. for curbing. John F. Bretz secured the contract for paving English avenue with brick at $1.67 a sq. yd. for paving and 52 cts. for curbing.

Springfield, O.—Contracts for improving five streets were awarded October 15 as follows: Factory street, J. F. McClure, $4,687.41; Catherine street, $888.68; Fremont avenue, Daniel Boyle, $967.10; Broadway, J. F. McClure, $761.74. The contract for paving Fountain square with brick was awarded to J. E. Brown for $2,122.78.

SEWERS.

Mayor Doremus, of Newark, N. J., invited the heads of municipalities along the Passaic river to meet in Newark October 24 for the purpose of forming a permanent organization which would have as its object the building of a trunk sewer.

CONTEMPLATED WORK.

Kirksville, Mo.—Council contemplates installing a sewerage system.

Lancaster, O.—The construction of a 3-ft. sewer on 5th St. is proposed.

McPherson, Kas.—Plans have been ordered prepared for a sewerage system.

Kokomo, Ind.—Bids will be asked for soon for building sewers in 6 streets.

Marshfield, Wis.—The construction of a sewer on Central Ave. is contemplated.

Crystal Falls, Mich.—The construction of sewers at a cost of $16,000 is contemplated.

Franklin, Va.—This city voted, Oct. 14, to issue bonds for building a sewerage system.

Black River Falls, Wis.—The question of constructing a sewerage system is being agitated.

Norwalk, O.—A sewer system and disposal plant are contemplated. John Laylin, cv. engr.

Waukegan, Ill.—Plans are being prepared for a sewer system for the north and west sides.

Woodlawn, Ala.—The immediate construction of a sewerage system is contemplated.—Mayor Perryman.

Hamilton, O.—Contracts will probably be let soon for constructing a system of sanitary sewers.

Rhinelander, Wis.—Council voted to build a sewer on Davenport St., from the Soo viaduct to the river.

North Yakima, Wash.—This city voted, Oct. 12, to issue bonds for constructing a sewerage system.

Barberton, O.—The construction of a brick and concrete sewer is contemplated. W. F. Robinson, vil. clk.

Boone, Ia.—Council has authorized the construction of a sewer system to the Fair Ground addition.

Lansford, Pa.—The question of issuing bonds for constructing a sewerage system will be voted on Nov. 7.

Fairbury, Neb.—The question of issuing $15,000 bonds for building sanitary sewers will be voted on Nov. 9.

Putnam, Conn.—The question of appropriating $50,000 for the purpose of constructing sewers will be voted on Nov. 2.

St. Louis, Mo.—An ordinance has been approved for constructing a 925-ft. extension of the Gimlin sewer, in Baden.

Winchester, Ky.—This city will vote in November on the issue of $40,000 bonds for constructing a sewerage system.

Lockland, O.—This village voted to issue $80,000 bonds for constructing a sewerage system. P. O. is Station R, Cincinnati.

South Bend, Ind.—Plans will be completed soon for constructing 4200-ft. of 60-in. trunk sewer extension on Kenwood Ave.

Mattoon, Ill.—Plans are being prepared for a drainage system for the northern part of the city. Claude L. James, cy. engr.

St. Charles, Mo.—Plans and specifications have been prepared for a sewerage system, the estimated cost of which will be $74,497.

Oklahoma City, Ok.—The question of issuing $450,000 bonds for improving the sewer and water systems will be voted on Nov. 14.

Wilmette, Ill.—Plans and specifications are being made for extensive relief sewer system. E. P. Dunshoe, sec'y. bd. local impvts.

Canton, O.—A resolution was approved Oct. 4 for building a sewer on Center St. from Allen St. to the main sewer. W. H. Smith, mayor.

Elyria, O.—An ordinance was passed Oct. 10 providing for the construction of sewers in dist. No. 1. Fred Norton Smith, prest. coun.

Covington, Ky.—The question of issuing $40,000 for the completion of Willow Run and certain trunk sewers will be voted on in November.

Portsmouth, O.—Plans have been prepared by engr. Bratt for a sewer system to drain the territory east of Offnere St. and south of 2nd St.

South Omaha, Neb.—The question of issuing $250,000 bonds for the purpose of constructing a general sewer system will be voted on Nov. 7.

West Hartford, Conn.—This town contemplates the construction of a branch sewer to connect with the intercepting sewer at Hartford, at a cost of $8,000.

Rock Hill, S. C.—Petitions are being circulated asking council to call a special election to vote on the question of installing a sewerage system.

East Grand Forks, Minn.—The bids for constructing 5 blocks of sewers were not opened and action was deferred until after the election to be held Nov. 7.

Marion, Mass.—The citizens of this town have accepted the report of the sewerage committee appointed to investigate the matter of building a sewerage system here. Dr. A. C. Vose, sec'y.

Congress Heights, D. C.—O. A. Emmons is president of the Congress Heights Citizens' Association, which has been appointed to secure a sewerage system for this place. P. O., Washington, D. C.

Carlisle, Pa.—A report will be made to council in November on the proposed sewerage system, after which action will be taken regarding the advisability of having plans prepared and the question voted on.

San Francisco, Cal.—A resolution for constructing a sewer in Union St., at a cost of $55,000, has been approved by the street committee. The city engineer has completed plans for a sewer in Mission St.

Chatham, Va.—Special. L. T. Randolph, cons. engr., of Blancksburg, Va., advises us that he has completed plans and specifications for the sewage disposal system for the Chatham Episcopal Institution here.

Concord, N. H.—Council has passed a resolution authorizing a sewer loan of $5,000. Surface drainage work will begin at certain points this fall, as now planned, and other improvements will be taken up next spring.

Ithaca, N. Y.—A report has been sub- & Whitman, of N. Y. City, regarding the question of increasing the efficiency of the sewerage system of this city. The

construction of a disposal plant at Fall Creek is recommended.

Concord, N. H.—A sewerage system in the Fosterville district, at a cost of $5,000 is contemplated.

Grand Rapids, Mich.—L. W. Anderson estimates that the cost of constructing a sewer to divert the sewage from the Soldiers' Home down the river will be $11,000, and it will be necessary to condemn land for the right of way at a cost of $3,000 to $5,000. Council has authorized the construction of a sewer system for the south end at a cost of $85,000.

CONTRACTS TO BE LET.

Yankton, S. D.—Sealed bids are asked until November 6 for constructing the Irene ditch. Ralph Case, co. audt.

Napoleon, O.—Bids are asked until November 6 for constructing sewers. Fred W. Hilgendorf, vil. clk.

Paterson, N. J.—Bids are asked until November 3 for constructing sewers in sundry streets. Robert Dalzell, st. comr.

Lake City, Minn.—Bids are asked until October 31 for constructing an eight-inch sewer in Prairie street. A. W. Corwin, recorder.

Columbus, O.—Sealed bids are asked until November 2 for constructing sewage purification works. Chas. H. Frank, sec. B. P. S.

Sheldon, Ia.—Sealed bids are asked until December 11 for constructing sewers and sewage disposal works. G. T. Wellman, cy, clk.

Aberdeen, S. D.—Sealed bids are asked until November 10 for constructing an extension to the sewerage system. A. N. Aldrich, mayor.

Grosse Pointe Farms, Mich.—Bids are asked until November 4 for constructing 1,800 ft. of pipe sewer in Kerby road. J. G. Armstrong, vil. clk.

Glendale, O.—Bids are asked until Nov. 6 for constructing 2,100 ft. of sewers on Oak ave. and 1,600 ft. on Sharon ave. J. G. Gutting, vil. clk.

Manila, P. I.—Sealed bids are asked until January 12 for constructing a system of sewers and appurtenances here. G. S. Lane, acting sec. Municipal Bd.

Chattanooga, Tenn. — Sealed bids are asked until November 7 for constructing brick and pipe sewers and sixty-eight manholes. A. L. Thomas, chmn. B. P. W.

Plainfield, N. J.—Bids are asked until November 6 for constructing 568 ft. of concrete sewers, with manholes, branches, etc. J. T. MacMurray, cy, clk.

Boise, Ida.—Sealed bids are asked until November 9 for constructing 23,300 ft. of eight-inch and 1,500 ft. of ten-inch pipe sewers, sixty manholes, fifteen flush tanks and four flush lines with settling basins. J. A. Beal, cy. clk.

North Yakima, Wash.—Bids are asked until November 6 for constructing a sewer system consisting of 2,350 ft. of wood stave pipe; 2,350 ft. eighteen-inch, 2,700 ft. fifteen-inch, 9,415 ft. 12-inch and 7,915 ft. ten-inch vitrified pipe sewer and sixty-two manholes. Ernest McCulloch, cy. engr.

CONTRACTS AWARDED.

Hammond, Ind. — James Healey was awarded the contract for constructing sewers in Hoffman and Towle Sts.

Coldwater, Mich.—D. E. Weage was awarded the contract for constructing a storm water sewer in the 2nd ward.

Akron, O.—The contract for constructing the South Akron main sewer was awarded to Hallinan Bros., for $31,113.80.

Stamford, N. Y.—Hager & Moxley, of this city, secured the contract for 2500-ft. of sewer on Lake St., for $2,700.

Georgetown, Ky.—The contract for building a sewerage system was awarded to John B. Graves, of this city, for $25,-150.

St. Paul, Minn.—Ryan & Johnson secured the contract for building a sewer in Cypress and Pacific Sts., for $2,260.

Lawton, Ok.—The contract for constructing storm sewers was awarded to J. O. Severns, of Guthrie, Oct. 5, for $38,700.

Fond Du Lac, Wis.—The contract for constructing storm and sanitary sewers was awarded to J. Rasmussen & Son, of Oshkosh.

St. Paul, Minn.—The contract for constructing a sewer on Baker and Manomin Sts., was awarded to J. M. Thornton, Oct. 12, for $4,395.

Houston, Tex.—The contract for enlarging the Buffalo sewer, from Commerce St. to the bayou, was awarded, Oct. 18, to Sargent & McClintock.

Cincinnati, O.—The contract for the extension of the Bloody Run sewer to Millcreek was awarded, Oct. 9, to Thos. P. Strack, for $171,355.

Lexington, Ky.—The contract for constructing new main sewers was awarded to the Hill-Gaynord Const. Co., of East St. Louis, Ill., for $78,049.

Rockford, Ill.—The contract for building sewers was awarded, Oct, 11, to G. Maffioli, of this city and S. Vandewalker, of Belvidere, for $5,200.

Albany, N. Y.—A contract for constructing sewers on Steuben St. and Western Ave. was awarded to the Cameron-Hawn Co., for $5,721.90 and $6,690 respectively.

Parkersburg, W. Va.—The contract for building a storm sewer in the 8th and other wards was awarded, Oct. 10, to J. W. Curry, for $15,173.

Salt Lake City, Utah—The contract for constructing a large intercepting sewer and for gravity sewer extensions was awarded to James Kennedy, of Fargo, N. D., for $117,490.

Warren, Pa.—Contracts for constructing improvements to the sewerage system were awarded, Oct. 9, as follows: Excavation and laying pipe, Frank McLaughlin; furnishing pipe, Rickett Hardware Co.

Milwaukee, Wis.—The contract for constructing section No. 3 of the intercepting sewer for the relief of the 30th St. tunnel sewer was awarded to Charles Forrestal, Oct. 13, at $7.50 a lin. ft., or $20,-000.

Reading, Pa.—The contract for constructing the 54-in. concrete main sewer was awarded to Joseph P. O'Reilly, of this city, and for building house sewers in 5 new districts to David Peoples, of Philadelphia.

Newark, N. J.—Bids were submitted Oct. 12 for constructing brick and concrete sewers in the 1st division of the Clinton annexation sewers, Sec. No. 3. The Wm. J. McCloud Co., of Elizabeth, N. J., secured the contract for $35,076.

Jackson, Mich.—The contract for constructing the Monkey Run sewer was awarded, Oct. 18, to E. J. Tobin & Co., of

this city, for $29,961.16. The Savage Construction Co., of Chicago, secured the contract for building the purification plant for $29,000.

WATER WORKS.

Bristol, Tenn.—City council voted, Oct. 18, to accept the proposition to purchase the water-works system of the Bristol-Goodson Water Co., at a cost of $150,000.

Schroon Lake, N. Y.—The Schroon Lake Water Supply Co. has been incorporated to supply water, etc., by Myron C. Pelkin, Charles H. Wilson, John R. Stanton and others.

Buffalo, N. Y.—The bursting of a supply pipe in Niagara St., Oct. 16, caused the worst water famine ever experienced in this city. The entire west side of the city was cut off, leaving 150,000 people without water.

CONTEMPLATED WORK.

Fayetteville, Ark.—A municipal water-works plant is proposed.

Rosalia, Wash.—The question of constructing water-works is still under consideration.

Paola, Kas.—This city voted Oct. 10 to purchase the water-works plant for $50,000.

Lancaster, Mass.—This city voted, Oct. 11, to appropriate $4,500 for extending the water mains.

Watervliet, N. Y.—The question of constructing a municipal water-works system is being considered.

Findlay, O.—Council voted to issue bonds to complete the water-works reservoir at a cost not to exceed $3,500.

Lompoc, Cal.—The Lompoc Water Co. will expend about $10,000 for improvements, including the construction of a dam.

Biloxi, Miss.—A resolution has been adopted providing for an issue of $15,000 bonds for extending the water mains.

Westfield, Mass.—The bd. of water comrs. have voted to take the water of the Little River for an additional water supply.

McKeesport, Pa.—The question of issuing $200,000 bonds for a filtrataion plant and water-works improvements will be voted on Nov. 7.

Jacksonville, Ill.—City council has decided to ask for bids for repairing and strengthening the Morgan lake dam. May or Davis.

Oklahoma City, Ok.—The question of issuing $450,000 bonds for improvements to the water and sewer systems will be voted on Nov. 14.

Fitchburg, Mass.—The bd. of ald. voted Oct. 17 to acquire land and extend the water service of the city to Lake Wachusetts in Westminster.

Palo Alto, Cal.—The bd. of trade has passed resolutions calling on the bd. of city trustees to issue $90,000 bonds for improving the water-works.

The question of constructing water-works systems is contmplated at the following places: Edgefield, S. C.; Donaldsonville, La.; Richmond, Minn.; Foley, Minn.; Elsinore, Utah.

Baltimore, Md.—The ordinance appropriating $40,000 to complete the laying of water mains in the burnt district has been favorably reported by the 1st branch of council.

Newark, N. J.—The question of increasing the water supply and improving the arrangement of the water mains in the residential streets throughout the city is proposed.

The question of issuing bonds for the contruction of water-works systems has been favorably voted on at the following places: Franklin, Va.; Wesson, La.; Iola, Kas.; Colquit, Ga.; Apalachicola, Fla.

Lee's Summit, Mo.—The Commercial Club engaged Wynkoop Kiersted, cons. engr., of Kansas City, to go over the territory adjacent to this city with a view to selecting a site for a water-works plant.

Worcester, Mass.—F. A. McClure, cy. engr., recommends an increase of storage on Tatnuck Brook to provide for practically all the run-off of its water-shed. He also favored the development of the Asnebumskit system.

Racine, Wis.—The Lincoln club has taken up the question of municipal ownership of the water-works plant, and a committee has been appointed to secure statistics from cities of the state owning water-works concerning cost, operation, etc.

Moberly, Mo.—Special. This city has under consideration the construction of new water-works, the supply to be secured from deep wells, and perhaps a water softening plant. The franchise of the private water company expires shortly. A report and estimates are being prepared by Richard H. Phillips, cons. engr., of St. Louis.

Springfield, Mass.—The bd. of water com'rs. nas submitted a majority report to the city council, recommending that the city resort to Little River as a source for a new water supply. A minority report was also submitted recommending the construction of a filtration plant at Ludlow, to provide a safe supply of water. Also, the construction of the Ax Factory reservoir, and to take legislative action towards taking a new supply of water from Huntington watershed. The bd. of health also recommends the immediate construction of a filtration plant.

CONTRACTS TO BE LET.

Winnipeg, Man.—Bids are asked until Nov. 6 for a steel well caisson. C. J. Brown, cy. clk.

Two Rivers, Wis.—Bids are asked until Nov. 1 for laying 350-ft. 4-in. water pipe. Lgt. & Water com'n.

Bratenahl, O.—Bids are asked until Nov. 16 for 85,000 bonds to be used for constructing a water-works system. Clifford A. Neff, vil. clk.

Fort Stevens, Ore.—Bids are asked until Nov. 7 for erecting a steel tank on a trestle. F. G. Hodgson, C. Q. M.

Independence, Kas.—Bids are asked until No. 15 for installing a mechanical filtration plant. T. N. Sickels, cy. clk.

Yuma, Ariz.—Bids are asked until 2 p. m. Oct. 31 for furnishing 1 filter and 1 tank. John S. Spear, supt. U. S. Indian School.

Manila, P. I.—Sealed bids are asked until Jan. 2 for constructing a gravity water supply. G. S. Lane, acting sec'y. municipal bd.

New York City—Bids are asked until Nov. 8 for furnishing water-tube boilers at the new Richewood pumping station. John T. Oakley, comr. water supply, etc.

Valley City, N. D.—Bids are asked until Nov. 6 for constructing 225-ft. 4-in. water main on 5th ave. and 2220-ft. 4-in. main on 4th St. W. T. Craswell, cy. audt.

Billings, Mont.—Bids are asked until Dec. 15 for constructing main canals, laterals and ditches, requiring 140,000-lbs. of steel and 1400-cub. yds. of concrete. U. S. Reclamation Service.

East Moline, Ill.—Bids are asked until Nov. 11 for constructing a water-works system, consisting of standpipe, pumps, engines, 17,980-ft. water mains, 30 hydrants, pumping station and reservoirs. W. H. Ammerman, vil. prest.

St. Louis, Mo.—Bids are asked until Nov. 7 for furnishing one 30-hp boiler for Fort Huachuca, Ariz.; one 40-hp. boiler for Ft. Ringgold, Tex.; one 40-hp. boiler and one compound pump for Ft. Wingate, N. Mex.; one compound pump for Ft. Logan, Colo. Col. F. Von Schrader, Depot Q. M.

Port Huron, Mich.—Sealed bids are asked until Nov. 3 for constructing the uncompleted part of the canal from Lake Huron to Black river, requiring 270,000,-yds. of excavation, double track railroad bridge, water gate at lake end, and 350-ft. of protection crib. R. D. O'Keefe, supt. B. P. W.

Toledo, O.—Sealed bids are asked until Nov. 6 for constructing section No. 1 of the filtered water conduit, being cont. No. 2, for the improvement of the water supply. Bids are also asked until Nov. 6 for constructing sec. No. 2 of the filtered water conduit, being 2900-ft. long. Harry Jones, sec'y. B. P. S.

Chicago, Ill.—Bids are asked until Dec. 1 for finishing and delivering at the w. w. shop on Ashland ave., nr. 22nd st., water meters of the disc type, as follows: 1100 5-8-in., 500 3-4-in., 200 1-in., 100 1 1-2-in., 80 3-in., 20 4-in., and 12 6-in. meters. J. M. Patterson, comr. pub. wks.

Glendive, Mont.—Bids are asked until Dec. 5 for constructing the Lower Yellowstone dam, a rock-filled, timber-cribbed structure, requiring about 500,000-ft. of lumber, 700 piles, 1600 sheet piles, 11,000-cu. yds. rock filling and rip-rap and 100-tons of steel, about 18-mis. northeast of this city. U. S. Reclamation Service.

Cincinnati, O.—Sealed bids are asked until Nov. 10 for manufacturing, furnishing and delivering steel pipe for the filtration plant and settling reservoirs, and for laying c. i. pipe, special castings and valves, etc., for the extension and betterment of the water distribution system. August Herrmann, prest. bd. trustees.

CONTRACTS AWARDED.

Troy, N. Y.—The contract for cleaning and grubbing the reservoir was awarded to Richard Ward, for $16,770.

Eagle Lake, Tex.—A franchise has been granted the Eagle Lake Mfg. Co. for installing a water-works plant here.

Newark, O.—The contract for constructing a water-works system was awarded the American Light & Water Co., for $267,442.85.

Waukegan, Ill.—Special. M. R. Miller, supt. pub. wks., says contracts for constructing water mains and appurtenances were awarded as follows: N. Butrick st., J. M. Healy, Chicago, $4,576.59; Grand ave., S. M. McDonough, city, $1,928.99; Washburn Special Dist., J. M. Healy, $3,993; Kennard st., W. J. Allen, city, $586; Southwest st., W. J. Allen, $531.

BRIDGES.

Akron, O.—Plans have been completed for the proposed Exchange st. viaduct. Cy. engr. Payne.

Elkton, Md.—The county comrs. have authorized the building of a new bridge over Miller's Run.

Van Buren, Ark.—The county comrs. have authorized the construction of 3 additional steel bridges.

Jamestown, N. D.—Bids are asked until Nov. 6 for constructing a combination bridge. Andrew Blewitt, co. audt.

Palmyra, Mo.—Bids are asked until Nov. 7 for constructing an iron bridge in South River twp. H. F. Kizer, rd. & br. comr.

Cleveland, Miss.—Bids are asked until Nov. 6 for building a pile bridge across Mound bayou. L. E. Edwards, clk. bd. supvrs.

Auburn, Ind.—Bids are asked until Nov. 8 for building 11 steel arches and repairing 1 steel bridge. Herman D. Boozer, co. audt.

Delphi, Ind.—Bids are asked until Nov. 6 for construtcing a bridge across Wild Cat creek, near Owasco. Fred H. Engel, co. audt.

Huntsville, Ala.—Bids are asked until Nov. 6 for building a steel bridge 1-mi. west of New Market on the New Hope road. Co. comrs.

Mankato, Minn.—Garden City twp. voted to issue $1,000 to aid in building a steel bridge over the Watonwan river at the Meservey ford.

Tipton, Ind.—Sealed bids are asked until Nov. 6 for constructing 2 bridges or arches in Jefferson twp. T. W. Longfellow, co. audt.

Des Moines, Ia.—A new concrete bridge across Des Moines river on Locust st., is contemplated by this city, to be built next spring.

Lakewood, N. Y.—The contract for constructing a municipal water-warks plant was awarded to Ellery Colby, of Owego, for $22,750.

Vale, Ore.—Bids are asked until Nov. 8 for constructing a steel wagon bridge over the middle fork of Malheur river at Riverside. Co. comrs.

Cleveland, O.—The question of selecting a site for the proposed new high level bridge connecting the East and West sides will be voted on Nov. 7.

Columbus, O.—Bids are asked until Nov. 9 for steel beams, reflooring and paved roadway construction over Green Lawn ave. bridge over the Scioto river. L. E. Jones, co. adut.

Portland, Ore.—A resolution is before council directing the city engineer to prepare plans for a steel bridge on Grand ave. across Sullivan's Gulch.

Barberton, O.—Bids are asked until Nov. 4 for constructing the abutments for a bridge over the Ohio and Erie canal.

on Robinson ave. M. D. Buckman, co. audt.

Monte Vista, Colo.—Bids are asked until Nov. 6 for constructing a combination bridge across Rio Grande river, near here. T. W. Jaycox, State engr., Denver.

South Bend, Ind.—Bids are asked until Nov. 8 for constructing a concrete substructure and removing Jefferson st., bridge to Springbrook Park, over St. Joseph river. Alonzo J. Hammond, cy. engr.

Bloomington, Ind.—Bids are asked until Nov. 7 for building an iron bridge with stone abutments; building 3 concrete bridges; building a cement bridge or an iron bridge with cement floor. Co. comrs.

Toledo, O.—Sealed bids are asked until Nov. 8 for constructing a retaining wall on the east side of each approach to the Wood and Lucas county joint bridge across Maumee river. D. T. Davies, Jr., co. audt.

Indianapolis, Ind.—Sealed bids are asked until Nov. 11 for building a bridge over canal at Broad Ripple; a bridge over Fall creek on 30th st.; riprap for Buck creek bridge on Michigan road Franklin twp.; retaining wall on Michigan road, Center twp. John McGregor, chmn. co. comrs.

Perth Amboy, N. J.—Sealed bids are asked until Nov. 1 for constructing 300 ft. of trestle approach to the Perth Amboy side of the county bridge over the Raritan river, between Perth and South Amboy. Asbury Fountain, director bd. chosen freeholders. Sealed bids are asked until Nov. 6 for constructing a trestle approach to a bridge to be built over the Raritan North Shore R. R. Wm. Fullerton, st. comr.

STREET LIGHTING.

York, Neb.—A municipal electric light plant is proposed.

Annandale, Minn.—The construction of an electric lighting plant is contemplated.

Edgefield, S. C.—This town voted to install an electric light plant.

LeGrand, Ia.—This town voted to erect a municipal electric light plant.

New Brunswick, N. J.—A municipal electric light plant is contemplated.

Menasha, Wis.—The installation of a municipal gas plant is contemplated.

Mooresville, N. C.—This town voted to construct a municipal electric light plant.

Alger, O.—This village will vote Nov. 7 on the issue of $3,500 for securing electric lights.

Plains, Pa.—An electric light plant is contemplated. J. Robertson Williams interested.

Birdsboro, Pa.—Plans are being prepared for constructing a municipal electric light plant.

Mt. Ayr, Ia.—A contract for supplying this town with gas was awarded to the Mt. Ayr Gas Co.

Paola, Kas.—This city voted, Oct. 10, to issue $25,000 for building a municipal electric light plant.

Missoula, Mont.—Bids are asked until Nov. 1 for lighting this city for 2, 3, 5 and 10 yrs. Cy. clk. Murphy.

Argenta, Ark.—Plans for an electric light plant are being considered. W. E. Pearsall, chmn. bd. impvt.

Kansas City, Mo.—Bids are asked until Nov. 17 for the Beardsley natural gas franchise for 30 yrs.

Marion, Ind.—The question of issuing bonds for installing a municipal electric light plant will be voted on Nov. 7.

Chatham, N. B.—Bids will be asked about May or June, 1906, for constructing a municipal electric light plant. P. J. McIntyre, town clk.

Richmond, Va.—The city attorney will prepare an ordinance providing for the issue of $500,000 bonds for the proposed electric light plant.

Everett, Wash.—City council has directed the city clerk to ask for bids for lighting this city with electricity for 5, 7 and 10-yr. terms.

Crawfordsville, Ind.—The contract for repairing the municipal electric light plant was awarded to J. F. Davies, of Toledo, for $8,538.

Rutherford, N. J.—Sealed bids are asked until 8 p. m., Nov. 3, for lighting the streets of this borough for 3 yrs. Wm. Black, chmn. lighting com.

Chattanooga, Tenn.—The Chattanooga Electric Light and Power Co. was awarded a contract, Oct. 10, for placing 68 20-c. p. incandescent lamps for lighting the streets of the Ninth ward.

Halifax, N. S.—Special.—Fred Monaghan, cy. clk., says that the city council has appointed a special committee to consider and report upon the advisability of establishing a municipal electric light light plant and the feasibility of utilizing a garbage disposal plant for the production of light and power.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Jackson, Mich.—T. McClelland is chmn. of a committee to select a site for a garbage crematory.

Grand Rapids, Mich.—City council is urged to take imediate action towards installing a new garbage burner.

St. Louis, Mo.—Plans and specifications were approved by the bd. of public improvements, Oct. 10, providing for municipal garbage incinerating plant.

Atlantic City, N. J.—An ordinance is pending in council providing for the work of street sprinkling by contract, instead of by the street department.

New York City—Bids are asked until Nov. 6 for the final disposition of garbage in the borough of Manhattan for 5 yrs. John McG. Woodbury, comr. st. cleaning.

Bridgeport, Conn.—The contract for collecting garbage, dead animals, etc., for 10 yrs. has been awarded to J. T. King and H. E. Reilley, of this city, at $2.32 a ton.

Kansas City, Mo.—The Decarie Mfg. Co. has made a proposition to Mayor Neff for installing an incineration plant in this city for $85,000 that would destroy all garbage and refuse, including street sweepings and alley accumulations.

PARKS.

Montclair, N. J.—The citizens of this town are in favor of the establishment of public parks.

San Jose, Cal.—A special election will be held to vote on the issue of $100,000 bonds for improving Alum Rock Park. Harry J. Edwards, park comr.

FIRE APPARATUS.

Middle River, Minn.—A fire company will be organized.

Deer Creek, Minn.—A fire department has been organized.

Mare Island, Cal.—Bids are asked until Nov. 28 for furnishing an auxiliary fire alarm system for the navy yard. Bureau supplies and accounts.

Sioux Falls, S. D.—Sealed bids are asked until Nov. 6 for 1,000 ft. of 2½-in. fire hose, and one combination hose and chemical wagon. F. L. Blackman, cy. audt.

TOO LATE FOR CLASSIFICATION

Ames, Ia.—This town will expend about $20,000 in the extension of the sewerage system.

Napoleon, O.—Bids are asked until Nov. 20 for constructing a sewer on Cary st. Vil. clk.

Peoria, Ill.—An ordinance is pending providing for brick paving on Western ave. and Adams st.

Keokuk, Ia.—The contract for macadamizing Morgan st. was awarded to McManus & Tucker, city, for $4,539.

Sterling, Ill.—The contract for paving W. 4th st. and Avenue A was awarded, Oct. 19, to A. E. Rutledge & Co.

Lincoln, Cal.—The question of constructing a sewerage system is being considered by the bd. of town trustees.

Manitowoc, Wis.—The contract for constructing sewers was awarded, Oct. 19, to Walter O. Bahr, for $40,000.

Salem, Ind.—Bids are asked until Nov. 6 for constructing 11,057 ft. of gravel roads. Frank E. Morris, co. audt.

Salina, Kas.—About 13 blocks of bitulithic paving in the business part of this city is contemplated. A. W. Godfrey, cy. clk.

Highlands, N. J.—The question of issuing $25,000 bonds for installing a water and electric light system will be voted on Nov. 8.

South Bend, Ind.—Sealed bids are asked until Nov. 8 for constructing 3 concrete culverts and 3 iron bridges. John W. Harbou.

St. Paul, Minn.—The contract for constructing a sewer on Cypress and Pacific sts. was awarded to Ryan & Johnson, for $2,260.

Pensacola, Fla.—Special.—Charles H. Bliss, mayor, says this city desires quotations on paving blocks and bricks laid here. The city is also in the market for a hook and ladder truck and 1,500 ft. of hose.

Kansas City, Mo.—Bids will be asked for paving Main st., from 13th to 19th, with asphalt or creosoted blocks under open specifications.

Midland, Mich.—The contract for constructing a sewerage system was awarded to the Phoenix Construction Co., of Saginaw, for $11,560.

Arbuckle, Cal.—Sealed bids are asked until 2 p. m., Nov. 7, for grading and constructing sewers on certain streets. J. W. Crutcher, clk. bd. supvrs.

Buffalo, N. Y.—Sealed bids are asked until 11 a. m., Nov. 1, for constructing brick and tile sewers on a number of streets. Francis G. Ward, comr. pub. wks.

St. Bernard, O.—Sealed bids are asked until Nov. 8 for constructing sewers in Church st., Meadow and Tower aves. and George st. Geo. Meyer, clk. b. p. s.

Terrace Park, O.—Bids are asked until Nov. 18 for the purchase of bonds to raise money to construct cement sidewalks on Rugby, Amherst and Park aves. W. E. Williamson, vil. clk.

Wauseon, O.—Special.—Bids were submitted for constructing sewers, Oct. 23, the lowest bidders being as follows: Chestnut st., W. H. Pontius and T. E. Rieger; Oak st., H. L. Wood.

Milwaukee, Wis. — The new electric lighting specifications were approved Oct. 17, and the bd. of pub. wks. authorized to advertise for bids for lighting the city for 1, 2, 3, 4, 5 or 10 yrs. The report in favor of advertising for sites for a municipal electric lighting plant was laid over for 2 weeks. A resolution was introduced Oct. 17 providing that this city establish a plant for mixing tar macadam and bitulithic pavement for the repair of streets.

Waukegan, Ill.—Special.—M. R. Miller, supt. pub. wks., says the contracts for constructing cement walks were awarded as follows: Washington st., I. H. Miller, $750; Genesee st., I. H. Miller, $417.12; Washington st., $148; N. Sheridan road, $399.85, and Sherman Pl., $372.50, Thompson & Smart, city; constructing retaining walls, N. Flemming, city, $1,317.

San Jose, Cal.—Special.—Charles H. Peiper, cy. engr., advises us that improvements are contemplated approximating a total cost of $300,000, as follows: Building sewers in certain streets; improving city reservation, known as Alum Rock Park, by constructing bridges, bathhouses, buildings, water-works, etc.; constructing and improving fire houses and appliances and the acquisition of further fire apparatus; construction and improvement of fire house, etc. G. D. Worswick, mayor.

BUSINESS DIRECTORY.

Concluded from page 15.

Trench Machines
Carson Trench Machine Co., Boston.
The Potter Mfg. Co., Indianapolis, Ind.

Tube Mills.
Krupp (Thos. Prosser & Son, New York City).

Vitrified Brick Blocks.
W. H. Arthur, Stamford, Conn.

Wall Coping.
East Ohio Sewer Pipe Co., Irondale, O.
Stratton Fire Clay Co., Empire, O.

Wall Coping Presses.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

Wall Ties.
Houston Bros. Co., Pittsburg, Pa.
Schilpp Bros., Pittsburg, Pa.

Water-proofing Formulae.
Gross & Horn, New York City.

Water-Works Plants.
Water-Works Construction Co., Pittsburg, Pa.

Wet Pans.
Turner, Vaughn & Taylor, Co., Cuyahoga Falls, O.

Wheel-Barrows.
Anderson Bridge and Scraper Co., Anderson, Ind.
W. H. Anderson & Sons, Detroit, Mich.
Austin & Western Co., Ltd., Chicago, Ill.

Wheel Scrapers.
Anderson Bridge & Scraper Co., Anderson, Ind.
W. H. Anderson & Sons, Detroit, Mich.
Austin & Western Co., Ltd., Chicago, Ill.

Whiffle rees.
Pittsburg Tubular Steel Whiffletree Co., Pittsburg, Pa.

Wire Rope.
W. H. Anderson & Sons, Detroit, Mich.

Wood Pavements.
Kettle River Quarries Co., Minneapolis, Minn.
Republic Chemical & Creosoting Co., Indianapolis.

Wood Split Pulley.
Dodge Manufacturing Company, Mishawaka, Ind.
The Jeffrey Mfg. Co., Columbus O.